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MACHINERY

Volume 53 JUNE, 1947 Number 10

Aircraft Production Progress

The fantastic volume of aircraft production reached during the war years is no longer being maintained, but there is a substantial peacetime output. The engineering brains of the industry are still being applied, not only in the development of larger and speedier commercial planes and aircraft for the supersonic realms, but also in the development of cost-saving manufacturing methods. Latest production processes of interest to general industrial executives, as well as to aircraft builders, are described in this issue—MACHINERY'S 9th Aircraft Production number.

Aircraft Engines of Tomorrow
IN PRODUCTION TODAY

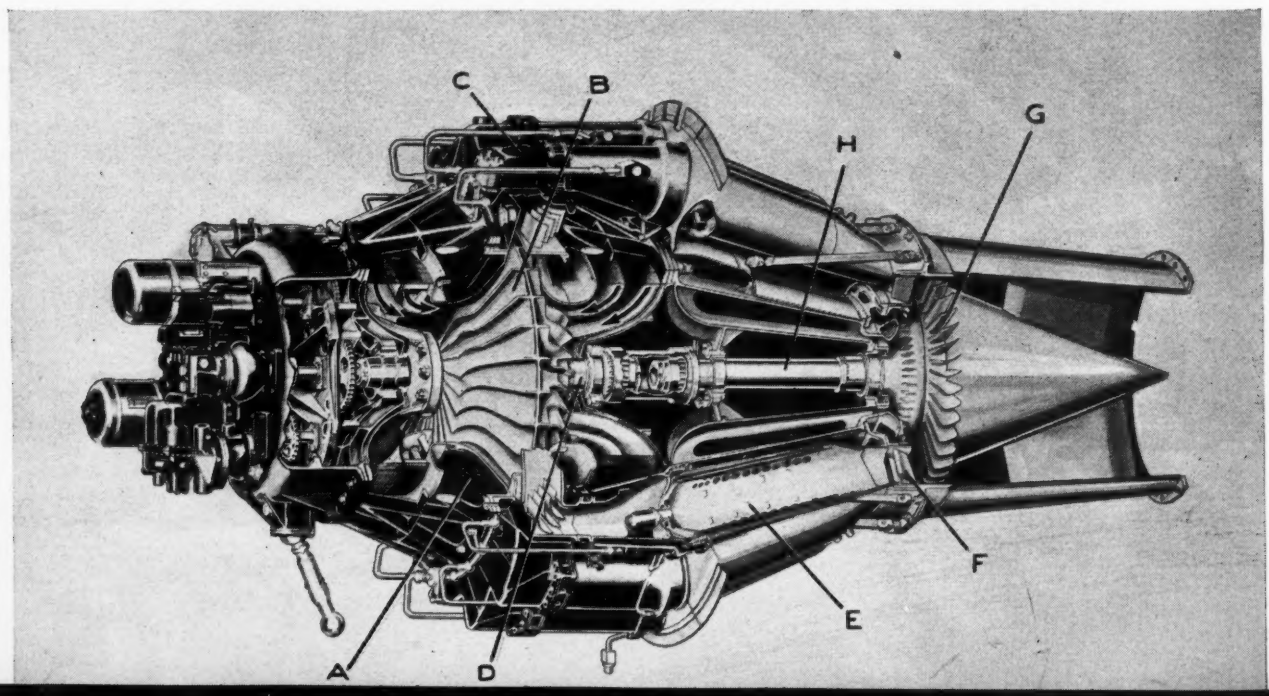
Jet Engines Require Unusual Tooling Set-Ups and Precision Machining Operations. Some of the Interesting Methods Employed by the Allison Division of the General Motors Corporation in Producing These Engines are Described for the First Time in This Article – First of Two Installments

By CHARLES H. WICK

AIRPLANES hurtling toward the enemy at speeds close to that of sound, during the latter part of World War II, heralded the first practical application of jet engines to aircraft. Ever since the development of the steam turbine, engineers have been striving to eliminate the problems involved in generating and superheating the steam required for this type of power plant and to harness the terrific power inherent in the burning gases themselves.

The success of the gas turbine required the design of extremely efficient components that could operate at high speeds and temperatures, and thus develop more power than that consumed by its compressor. Only in the past few years have metallurgists been successful in de-

Fig. 1. Centrifugal-flow Compressor Type of Jet Engine Used to Power the P-80 "Shooting Star," the Speed of which Approximates that of Sound



veloping materials that could withstand the heat and centrifugal force generated by a gas turbine. The unusual tooling set-ups and machining operations employed at the Allison Division of the General Motors Corporation are described in this article.

To appreciate the engineering problems involved in tooling for and machining parts of this engine, it will be well to understand something of the operation of the engine. The Allison jet engine, shown in Fig. 1, is used in the Lockheed P-80 "Shooting Star," and, in conjunction with two Pratt & Whitney reciprocating engines, in the new Martin XP4M-1 patrol bomber.

Cold air is sucked into the single-stage, centrifugal-flow compressor, as indicated by arrows at the left of the engine. This compressor consists of a casing *A;* an impeller *B;* a diffuser *C,* which directs compressed air to the combustion chambers; and an impeller shaft *D,* which is connected by a flexible splined coupling to the turbine rotor shaft. The impeller rotates at 11,500 R.P.M., and forces 79 pounds of air per second, compressed in the ratio of 4.1 to 1, to the combustion chambers.

The fourteen interconnected combustion chambers *E* each contain a perforated flame tube and a fuel injection nozzle. Here combustion occurs with an excess of air, insuring the complete burning of the fuel and the heating of the excess air to a temperature of about 1560 degrees F.

This hot mixture of air and combustion gases enters the single-stage, axial-flow gas turbine and is directed by stationary guide vanes *F* onto the blades around the periphery of the rotor wheel *G.* Here approximately one-quarter of the energy in the gases is expended to turn the rotor and thus drive the impeller; the remaining three-quarters of the energy develops the reaction which thrusts the airplane forward. Ingenious design of the turbine permits turbine shaft *H* to operate at relatively low temperatures, the bearings on this shaft seldom exceeding a temperature of 200 degrees F. This shaft can therefore be made of a less critical, more machinable steel, which is flash-welded to the rotor wheel in an operation to be described in the next installment.

This is the only centrifugal-flow compressor type of jet engine made in this country. Originally designed by the General Electric Co., all production and engineering is now concentrated at the Allison Division of the General Motors Corporation in Indianapolis, Ind.

The double-entry impeller is machined from a "finger" forging of 25S-T aluminum alloy. The 465-pound weight of this forging, which is 30 inches in diameter by 11 3/4 inches wide, is reduced to 240 pounds by machining. After removing about 1/4 inch from all the outer surfaces of the forging in an operation performed on a vertical turret lathe equipped with a duplicating attachment, excess stock is removed from

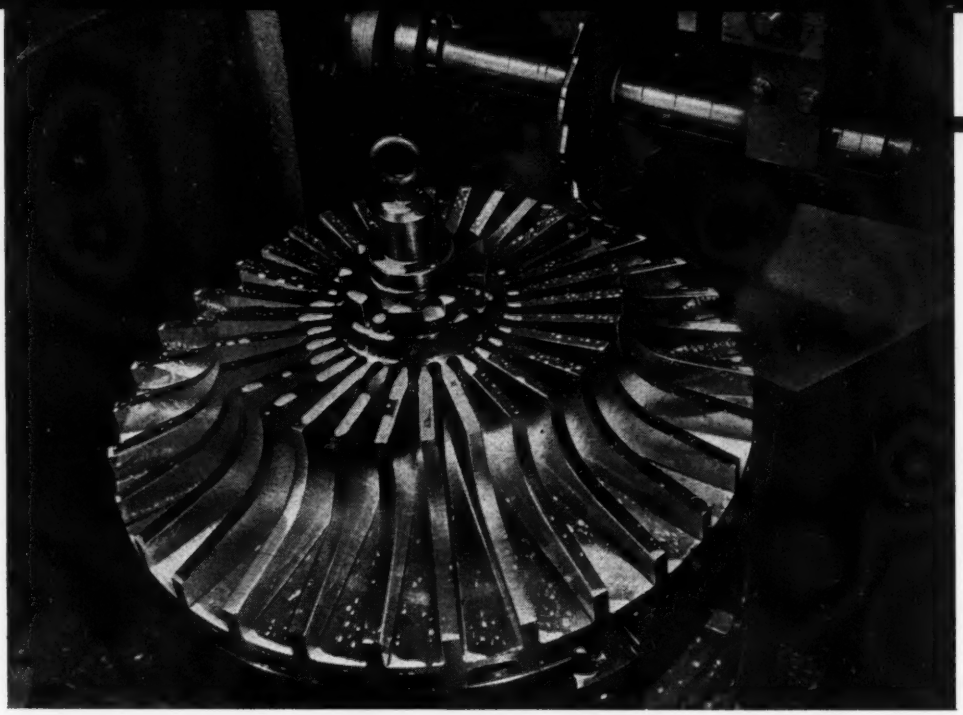


Fig. 2. Sweep-milling Operation that "Hogs Out" Metal from between the Vanes of the Impeller Forging as it is Oscillated and Fed toward the Cutter

between the vanes of the impeller by means of the sweep-milling operation shown in Fig. 2. A special sweep-milling cutter, 13 1/2 inches in diameter by 13/32 inch wide, mounted on the arbor of a ram type hydraulic milling machine, is rotated at 340 R.P.M. The twelve teeth of this cutter are tipped with tungsten carbide.

A hub adapter is placed on the impeller before it is mounted on the oscillating indexing fixture, which is located at one end of the table of the machine. A V-shaped segment of aluminum alloy, varying from 3/8 inch wide near the center of the impeller to 2 3/8 inches wide at the periphery of the part, and from 3/8 to 1 inch deep, is removed from between adjacent vanes. The oscillating work is advanced toward the milling cutter at the rate of 0.018 inch per revolution.

This roughing operation removes approximately 3/8 inch from the faces of each vane, allowing 1/32 inch for a subsequent straddle-milling operation. It is necessary to index the impeller thirty-one times to complete this sweep-milling operation, and then reverse the part to mill the vanes on the opposite side. The milling of each side requires sixty-seven minutes.

After straddle-milling the vanes on machines

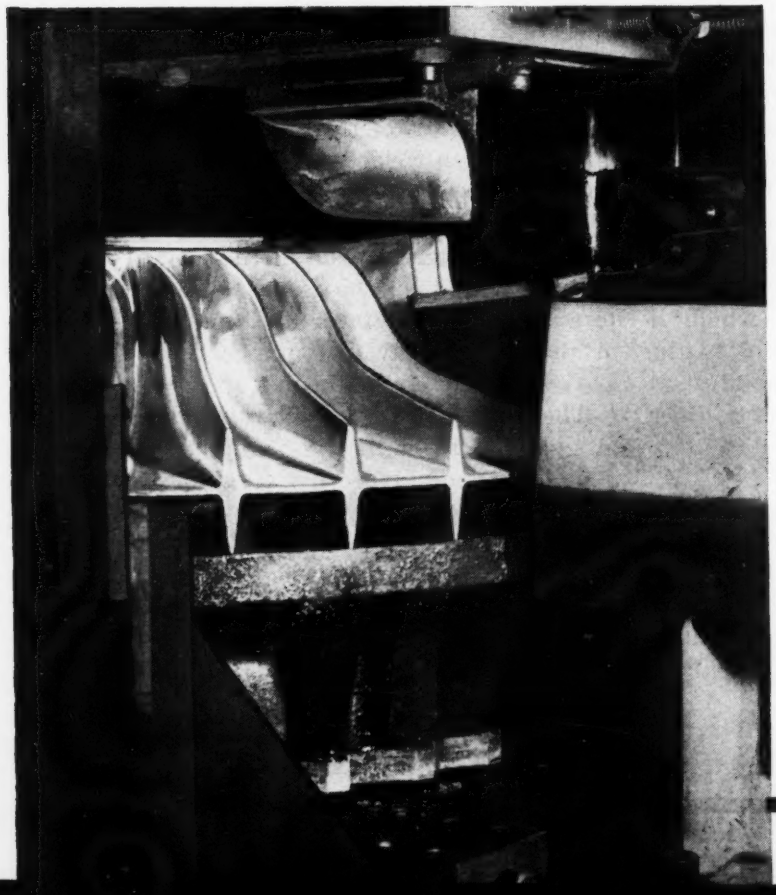


Fig. 3. After the Impeller Vanes have been Machined as Shown in Figs. 2 and 4, the Outer Edges of the Vanes are Bent to the Desired Contour on a 40-ton Hydraulic Press by the Set-up Illustrated

Fig. 4. The Impeller Vanes are Bevel-milled on a Special Machine Equipped with a Side-cutting End-mill, a Pair of Straddle Milling Cutters, and a Fly Cutter

similar to those used for the sweep-milling operation (except that the oscillating feature is omitted from the indexing fixture), the vanes are bevel-milled on the special machine shown in Fig. 4. The vertical spindle shown at the left is equipped with a carbide-tipped, side-cutting end-mill that is rotated at 800 R.P.M. and fed at 0.0075 inch per revolution to cut an 8-degree bevel on one face of each vane.

A pair of three-bladed, straddle milling cutters, mounted on the rear spindle of the machine, are revolved at 240 R.P.M. and fed at 0.025 inch per revolution to mill a 17-degree bevel on one face of each vane and an 8-degree bevel on the opposite face, and to blend these angular surfaces with fillets at the base of the vanes.

A three-tooth, carbide-tipped fly cutter, mounted on the spindle at the right of the machine, mills a 6-degree bevel on one face of each vane. This fly cutter is rotated at 180 R.P.M. and fed at 0.032 inch per revolution. Thirty-one indexings are necessary to bevel the vanes on each side of the impeller, the operation requiring 46 1/2 minutes.

The vanes on both sides of the impeller are then bent to the desired contour on a 40-ton hy-

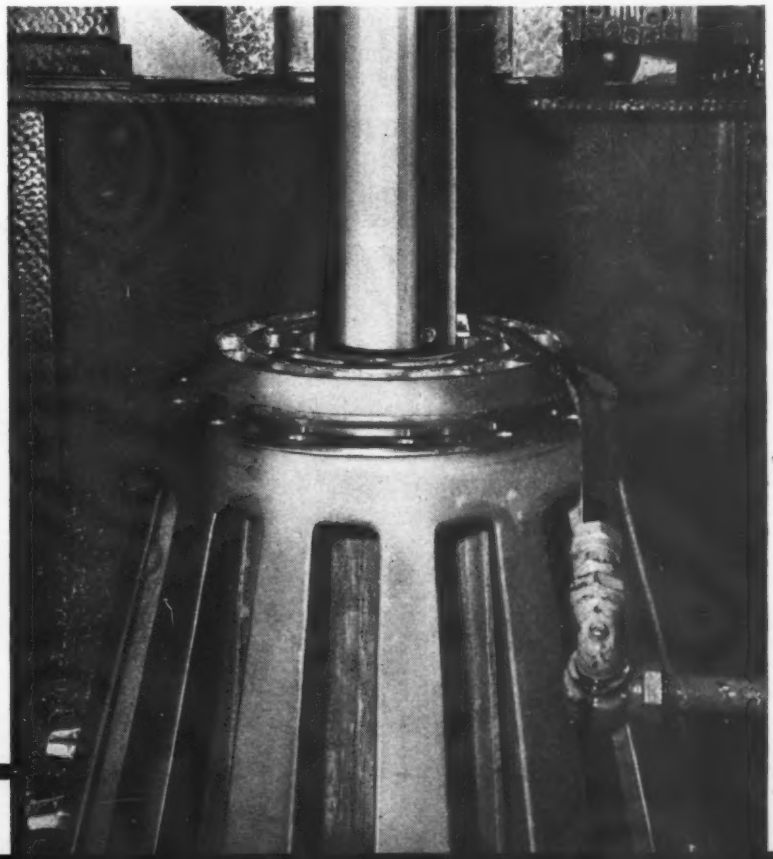


Fig. 5. A Magnesium Turbine Bearing Support Casting and Its Steel Liner are Bored in One Set-up on a Vertical Turret Lathe. The Liner is Pressed into the Casting prior to the Boring Operation

Fig. 6 The Profile of a Magnesium-alloy Compressor Casing is Generated by a Duplicating Attachment Mounted on a Vertical Turret Lathe

draulic press by means of the set-up shown in Fig. 3. Before bending, the impellers are placed in a batch type, gas-fired furnace and annealed for ten hours at 750 degrees F. and for two hours at 650 degrees F. Each impeller is then transferred to a fixture shown mounted on the bed of the press.

A knife-shaped die is advanced to a position between two adjacent vanes by means of a pneumatic fixture at the rear of the press. The ram is then lowered and a punch on its under side bends a single vane to the required contour. The specified distance between the outer edges of two adjacent blades is held within $\pm$ 0.015 inch.

The impeller is indexed until all thirty-one vanes have been bent. It is then transferred to an adjacent press, set up to bend the vanes on the opposite side of the impeller. Between each bend, vegetable oil is applied to the punch to facilitate the operation.

Previously, it was necessary to reheat each impeller three times in bending the vanes on one side. Now the vanes on both sides of the impeller are bent with only one heat in fifteen minutes. After bending, the impellers are reheated to 750 degrees F. in order to oxidize the lubricating oil on their surfaces. When the impellers have been removed from the furnace and allowed to cool to room temperature, they are anodized, heat-treated for ten hours in a bath maintained at 960 degrees F., quenched in boiling water, and age-hardened for twenty-four hours at 350 degrees F. After inspection, the hub faces are finish-machined to hold them square with the

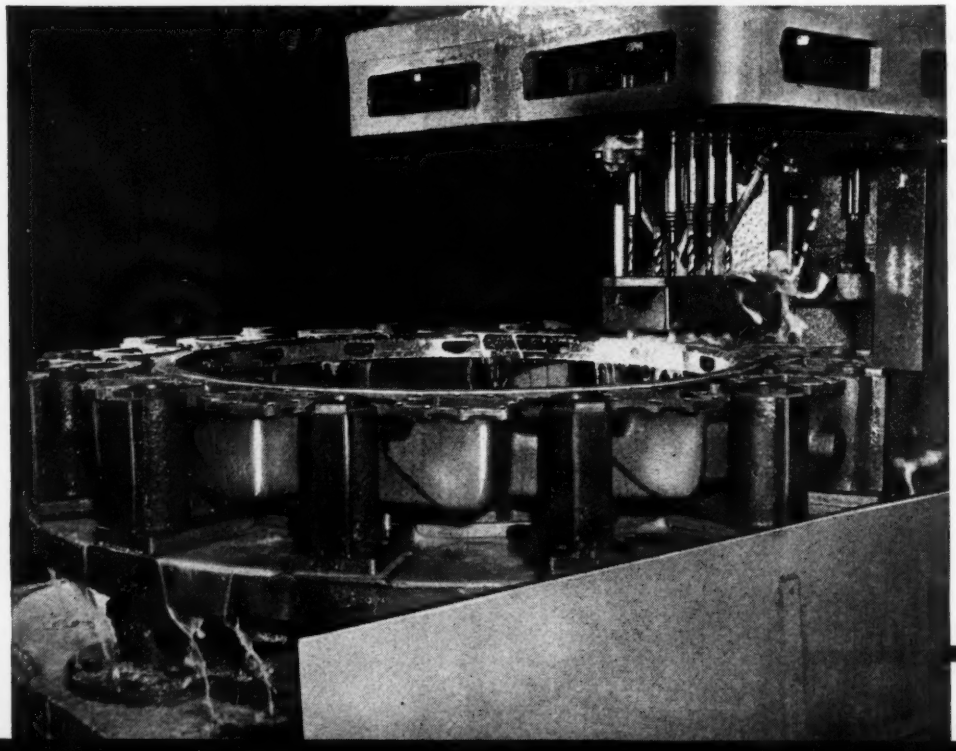


Fig. 7. Twelve Holes in Each of the Fourteen Air Adapter Mounting Pads on This Intricate Diffuser Casting are Drilled Simultaneously on a Multiple-spindle Machine

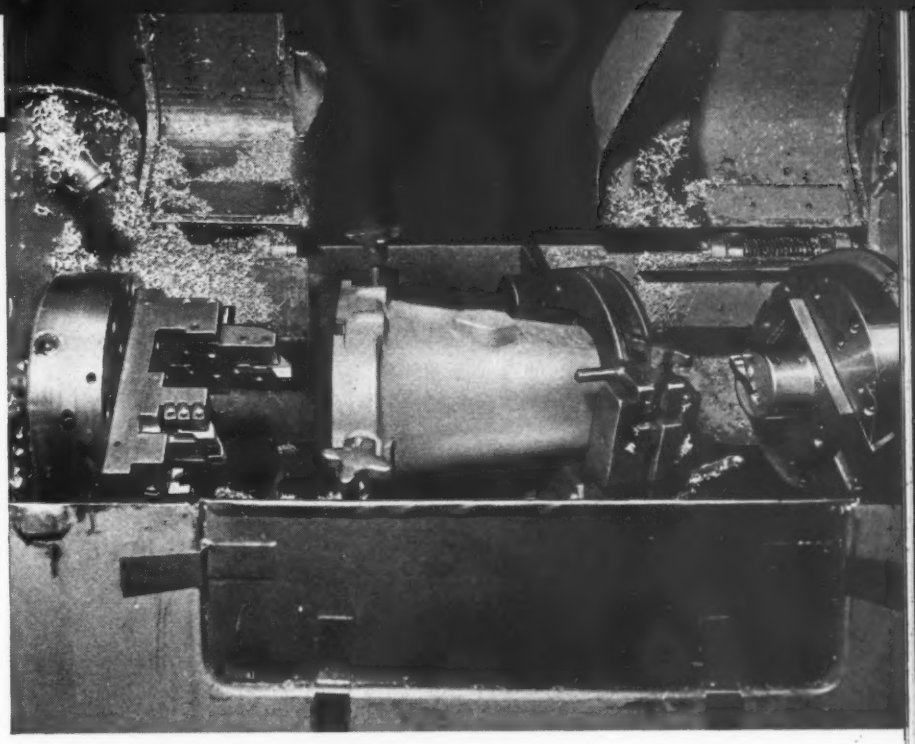


Fig. 8. Air Adapter Castings are Bored, Turned, and Faced on This Double-end Boring Machine which is Equipped with a Special Angle-facing Head at the Right

center line of the impeller within a total tolerance of 0.0003 inch.

The turbine bearing support of this turbo-jet engine is a magnesium-alloy sand casting having a tensile strength of 33,000 pounds per square inch and a Brinell hardness of 65. An unusual operation is the boring of this magnesium casting and its steel liner in the same set-up. This operation is performed on a vertical turret lathe, as shown in Fig. 5. The two bores are approximately 14 inches apart.

The magnesium-alloy bore, which is 61/64 inch wide, is finish line-bored to from 5.499 to 5.500 inches by removing approximately 0.060 inch of stock. The single-point, carbide-tipped boring tool used for this operation is fed at 0.008 inch per revolution, and the work is rotated at 133 R.P.M. The same tool is used for boring the steel liner, about 0.030 inch being removed from the diameter. In this operation, the work is revolved at 53 R.P.M. and the tool feed is the same as for the operation just described. The steel bore only is then reamed for size and finish. A 5.249-inch diameter, floating, self-centering reamer fed at 0.021 inch per revolution, with the work rotating at 43 R.P.M., removes approximately 0.010 inch from the 1 1/2-inch wide bore of the steel liner in this operation.

The compressor casing is also a magnesium-alloy casting. A pair of these castings forms a housing for the impeller when installed in the jet engine. The curved surface of the casting is generated on a vertical turret lathe equipped with a duplicator, as shown at the upper right in Fig. 6. Approximately 1/8 inch of stock is removed in the roughing operation. A subsequent finishing operation, performed on a similar machine, removes 1/32 inch of material.

Since the cutting point of the tool is constantly changing, a special, round-nosed, carbide-tipped tool is employed for this operation. The work is revolved at a speed of 168 R.P.M., and the tool

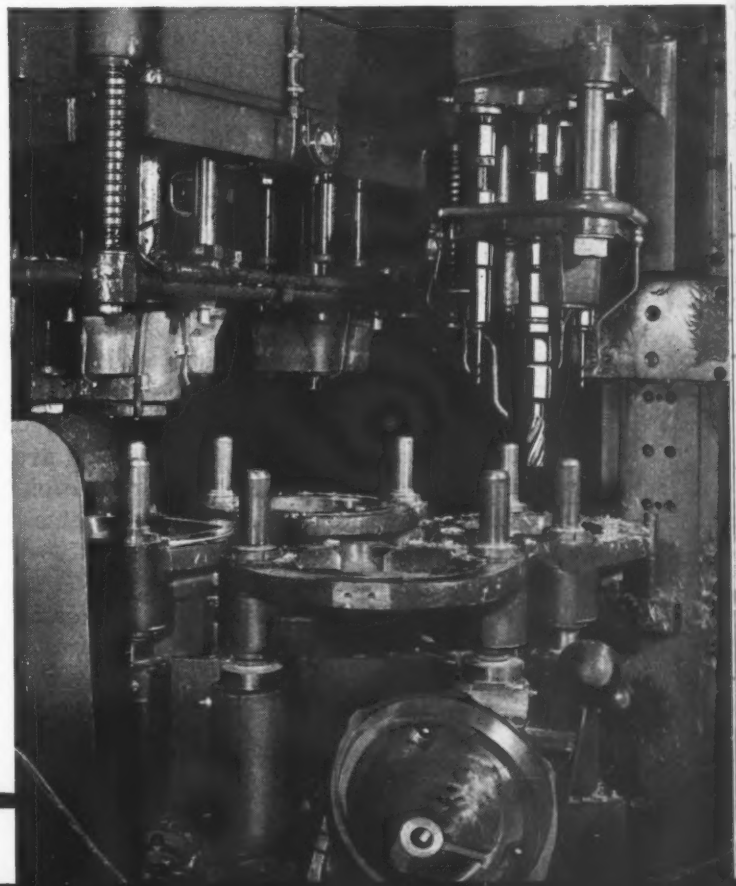


Fig. 9. A Four-station Special Machine is Employed to Drill and Tap Four Holes in the Magnesium-alloy Air Adapter Castings

Fig. 10. The Mid-frame Casting for an Axial-flow Type of Jet Engine is Turned, Back-faced, and Bored on This Special Two-spindle Machine

traverses the profile at the rate of 0.008 inch per revolution.

The diffuser, with tangential outlets and vaned elbows to carry the compressed air from the impeller to the fourteen air adapters, which direct it to the combustion chambers, is the most complex casting employed in the jet engine. It is a permanent-mold casting made of the same magnesium alloy as that used for the turbine bearing support and compressor casing. Approximately sixteen hours of hand burring, filing, and grinding are required on each of these castings prior to any machining. Dimensions are held to $\pm$ 0.010 inch in these hand operations.

One of the machining operations on this intricate casting is the simultaneous drilling of twelve holes in each of the fourteen air adapter mounting pads, as shown in Fig. 7. Ten letter U (0.365 inch diameter) step-drills and two 17/32-inch diameter drills are mounted in a multiple-spindle vertical drilling machine. The ten smaller holes are drilled through the 1/2-inch thick flanges and countersunk. The two larger holes are drilled to a depth of 1 11/32 inches—too deep for step-drills—making a subsequent countersinking operation necessary. All drills are revolved at 1200 surface feet per minute and fed at 0.005 inch per revolution. These holes are individually tapped in a subsequent operation. It is necessary to index the part fourteen times, and the time required to complete each diffuser is eighteen minutes.

The air adapters are also cast of the same magnesium alloy. These parts are bored, turned, and faced on a double-end boring machine equipped with the special angle-facing head shown at the right in Fig. 8. This angular head is equipped with a single carbide-tipped facing tool. The head at the left-hand end of the machine is equipped with six carbide-tipped boring, facing, and turning tools. Both spindles are rotated at 500 surface feet per minute and fed at 0.007 inch per revolution, completing an air adapter every two minutes. Dimensions are held to a tolerance of $\pm$ 0.001 inch in this semi-finishing operation.

Following this operation, the air adapters are drilled and tapped in the special vertical hydraulic machine seen in Fig. 9. A single part is loaded and unloaded at the first station, shown in the foreground. At the second station, seen at the left, one 0.9271-inch diameter drill is revolved at 250 surface feet per minute to drill a hole 1 61/64 inches deep, and three No. 26 (0.147-inch diameter) drills are rotated at 115 surface feet per minute to drill holes 3/4 inch deep. At the next station, the larger hole is countersunk at 300 surface feet per minute, and the three smaller holes are counterbored and countersunk with step-drills revolving at 240 surface feet per minute. At the final station the central hole is rough-tapped with a 1-inch–14 National Fine thread, and the other three holes are rough-tapped with a No. 10-24 National Coarse thread. The speed of the taps mounted on these lead-screw type tapping heads is 35 surface feet per minute. An adapter is completed every two minutes on this automatic machine.

The aluminum-alloy mid-frame for an axial-flow type of jet engine is shown being turned,

Fig. 11. Eight Mounting Pads of the Aluminum-alloy Mid-frame are Bored, Faced, Drilled, and Tapped on a Special Five-way Machine

back-faced, and bored on a special two-spindle machine in Fig. 10. Approximately 1/16 inch of stock is removed in turning the peripheries of the eight nozzles. The hooked tool at the top of the front spindle removes 0.038 inch of stock from the back face of each nozzle flange. The bores are finished by removing approximately 1/16 inch of stock. It is necessary to index the part eight times to complete this multiple turning operation.

The eight mounting pads on the same part are bored, faced, drilled, and tapped on the five-way special, horizontal machine seen in Fig. 11. The upper part of the fixture and the hinged cover have been removed to show the tooling. The spindle shown at the left holds four carbide-tipped tools that rough-face and bore the mounting pad. The next spindle to the right carries four 21/32-inch diameter step-drills. At the following spindle, three carbide-tipped tools are used to finish-face the pad. A single-point tool, mounted on the fourth spindle, is used to finish the bore. The four holes drilled at the second station are threaded at the last station with 3/4-inch–10 National Coarse taps. Eight indexings are performed to complete each mid-frame.

This article has been confined to the unusual machining operations performed on the magnesium- and aluminum-alloy parts of the jet engine. The second installment, to be published in July MACHINERY, will deal with the difficult machining, welding, and grinding operations required on the heat-resistant steel turbine rotor wheel and buckets.

Hot Dimpling and Joggling 75S-T

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Practice of the Douglas Aircraft Company in Extensive Application of the New High-Strength Aluminum Alloy

HIGHER standards of performance were visualized by Douglas engineers for the new DC-6 commercial transport planes by the adoption of 75S high-strength aluminum alloy throughout the structure of these planes. The utilization of this alloy in place of the 24S alloy used in the past has resulted in a weight reduction of 800 pounds per plane without sacrifice of quality. As every aircraft engineer knows, such a weight reduction is an important factor in increasing the payload of a plane. It is believed that the DC-6 is the first commercial airplane to be constructed from 75S alloy. The alloy is used in the form of sheets, extrusions, and, to a lesser extent, bar stock.

The adoption of 75S aluminum alloy presented numerous production problems; a great amount of research was necessary to determine which operations could be satisfactorily performed in the aged (T) condition and which had to be done in the annealed (O) or in the "as quenched" (W) conditions.

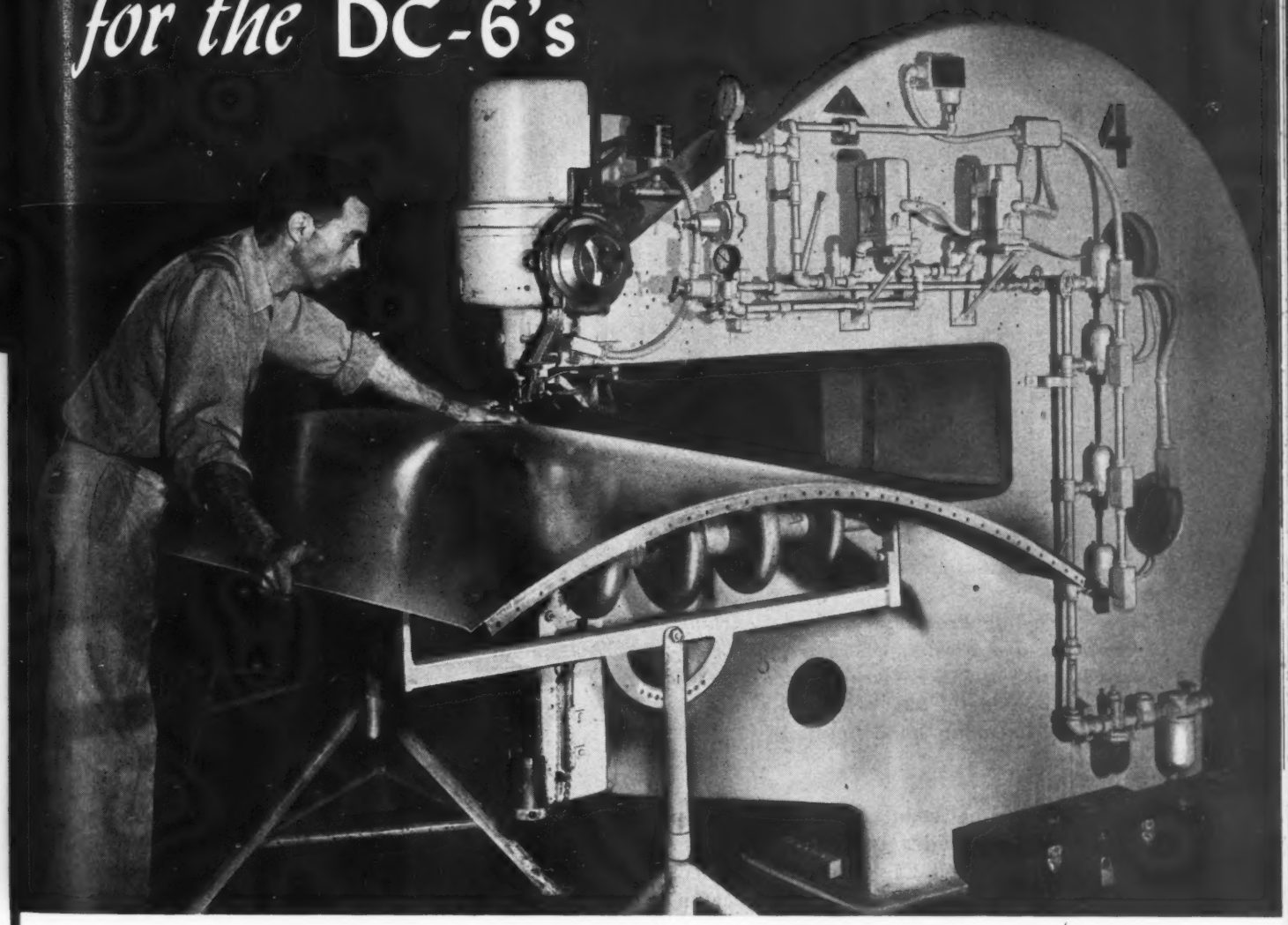
All dimpling and combined dimpling and riveting operations are performed on the 75S alloy in the T condition while the material in the immediate vicinity of each dimple is at a temperature of approximately 325 degrees F. In no instance should the sheet temperature exceed 400 degrees F. for more than five seconds, as such overheating may permanently weaken the sheet. This heating is accomplished in the dimpling machines, and the operation is performed the instant the required temperature has been attained in the small localized area surrounding the dimple. Joggling operations, which consist of making small reverse bends in extruded or rolled shapes to obtain an offset, are also performed successfully by heating the 75S-T alloy on the punch presses in which the work is to be performed.

Three methods of heating the material by electrical means were studied. Resistance and induction heating were discarded in favor of heating by thermal conduction. Thermal conduction technique was judged the most practical as regards simplicity of equipment and safety of the product, from a metallurgical standpoint. In combined punching, dimpling, and riveting operations, however, resistance heating is applied as a "booster" to the conduction heating.

All the machines in which the hot dimpling operations are performed are provided with dies and punches equipped with heat capacitors. Heat is transferred from the capacitors through the die and punch members to the aluminum-alloy sheet through thermal conduction. By closely regulating the temperature of the capacitors and the length of the heating cycle, the temperature of the sheet at the instant of punching and dimpling and the extent of the heated area can be closely controlled.

A typical punching, dimpling, and riveting operation is being performed on the Erco machine shown in the heading illustration. From the close-up view of the tooling in Fig. 1, it may be observed that the die button is equipped with a heated block that maintains the die temperature at between 350 and 450 degrees F. The lower die has another heated block that holds its temperature at between 525 to 575 degrees F.

for the DC-6's



These blocks are the heat capacitors previously referred to. They are constructed from Mallory metal with cartridge type electric heater units recessed in the metal. Thermo-couples embedded in the heated blocks control the die temperatures by means of pyrometers. The use of electronic timers to provide precise time delay after the tools come in contact with the sheet insures the attainment of a sheet temperature between 300 and 325 degrees F. before the punching and dimpling operation starts. Fig. 3 shows the die button in the preheat position.

When the operator depresses a button to start the machine, the ram comes down under reduced pressure air input to grip the material between the upper and lower dies. After a timed dwell period long enough to allow the material to reach the working temperature, the punch and dimple sequence is initiated. During the dwell period, electric current is passed through the material to speed the heating cycle. At the end of the dwell period, an electronic timer turns the current off and opens a solenoid valve which applies full air-line pressure to the ram cylinder for the simultaneous punching and dimpling operation. Contact arcing normally associated with resistance heating has been eliminated by controlling the current cycle so that current flows only while pressure is applied.

Near the front of the machine on the right-hand side, as seen in the heading illustration, are two air gages. The top gage indicates the air pressure to the ram. The pre-pressures are between 14 and 20 pounds per square inch, the value depending upon the material gage. A pressure of 60 pounds per square inch is used to complete the dimple. The lower gage indicates the pressure that is applied to the stripper pad. Air valves for controlling the mechanical operation of the machine may also be seen. It has been found advantageous to mount all such equipment externally for accessibility.

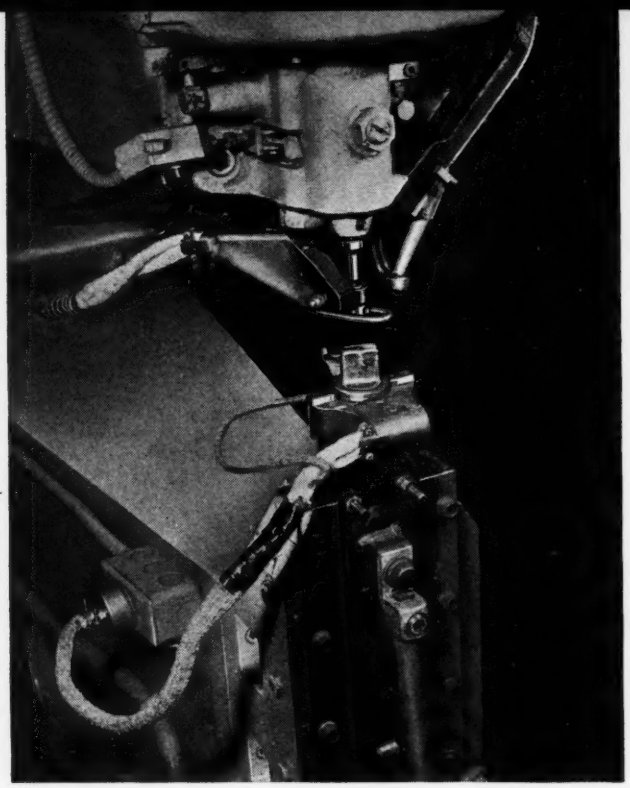


Fig. 1. Tooling Provided on Erco Punching, Dimpling, and Riveting Machines for Localized Heating of 75S-T Aluminum-alloy Sheets to Approximately 325 Degrees F. before Punching and Dimpling

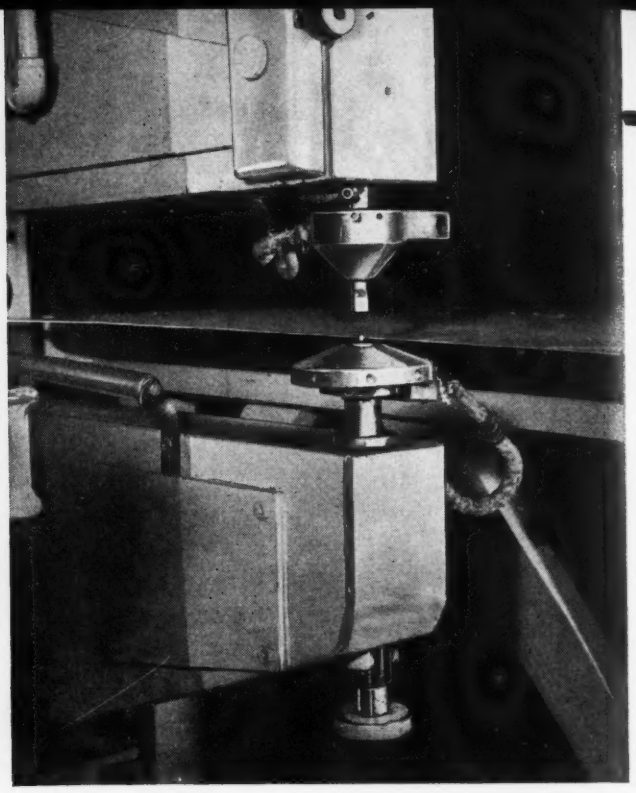


Fig. 2. Close-up View of the Tooling on the Squeezer Type Dimpling Machine Seen in Fig. 5, Showing the Electrical Connections to the Capacitors Employed in Localized Heating of the Sheets

The control panel seen at the left of the ram head in Fig. 4 provides manual control of the riveter sequence, and has a knob for selecting the pre-dwell interval. The meter indicates the amount of electrical current passing through the sheet during the resistance heating cycle. Further to the left is the pyrometric controller used to indicate and control the temperature of the lower heat capacitor. This can also be used to check the die-button heater. The large box contains the electronic timer, the current transformer, and the other controls required to electrify the air-operated riveter.

In setting up each machine, the working temperature is checked by punching, dimpling, and riveting specimen sheets, 3 inches wide by 12 inches long, which have been coated with "Tempilaq" of the type that melts at 300 degrees F.

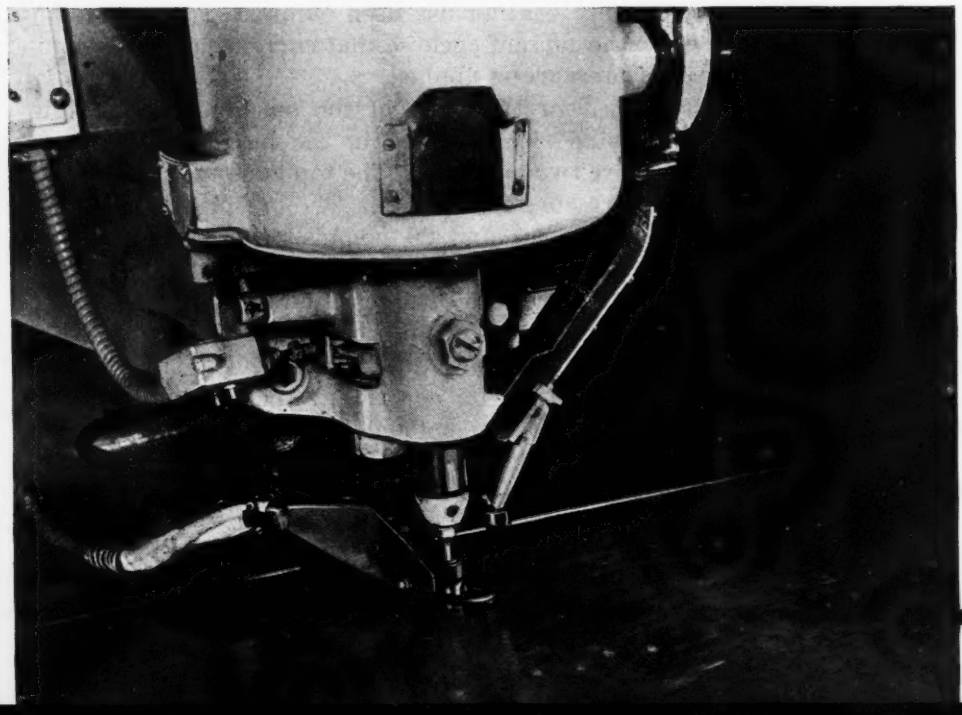


Fig. 3. Close-up View of the Machine in the Heading Illustration, Showing a 75S-T Aluminum-alloy Sheet in the Machine about to be Punched, Dimpled, and Riveted

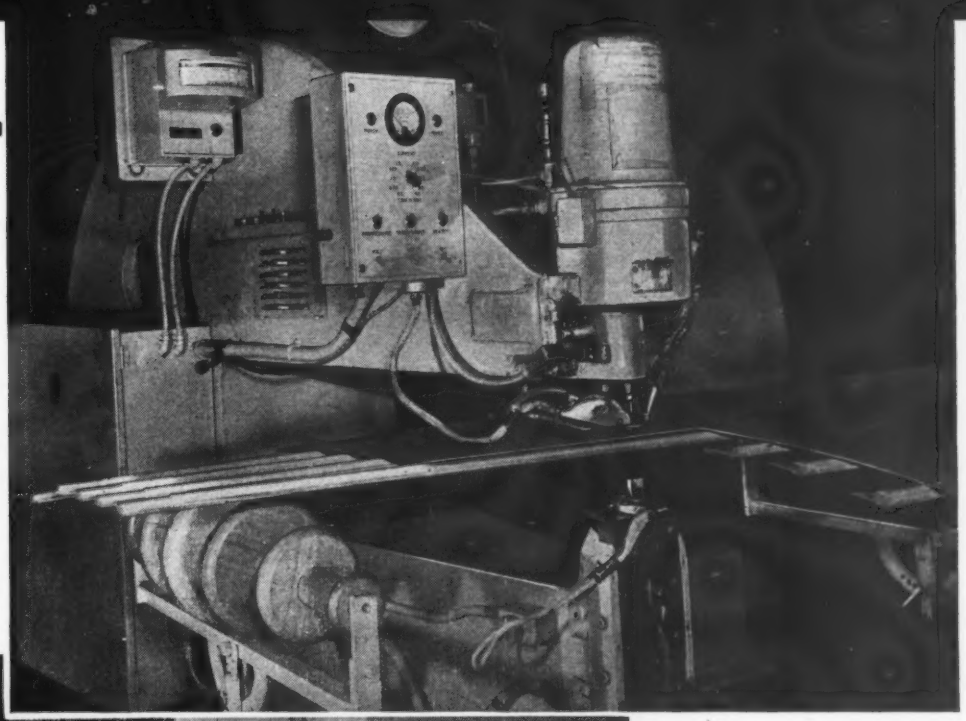


Fig. 4. General View of an Erco Punching, Dimpling, and Riveting Machine which Shows the Arrangement of the Heat Indicating and Controlling Instruments Mounted on the Left-hand Side of the Frame

Fig. 5. Performing a Hot Dimpling Operation on Pre-drilled 75S-T Aluminum-alloy Sheets on a Chicago Pneumatic Machine

Fig. 6. Vibratory Equipment Employed for the Hot Dimpling of Deicer Dimples on the Leading Edge of Airplane Wings

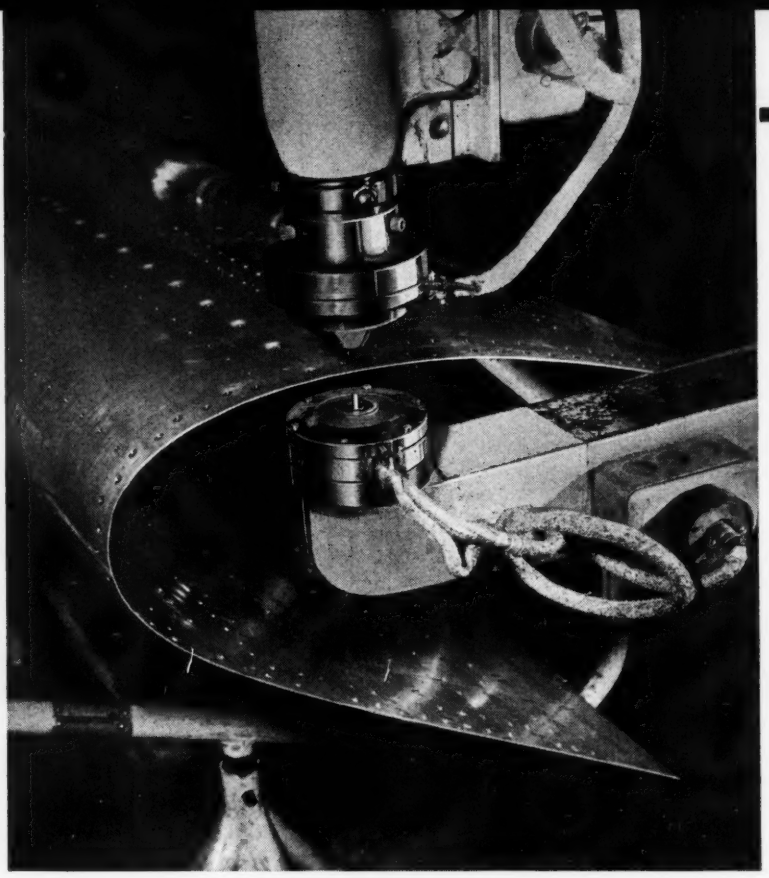


Fig. 7. Close-up View of the Conduction Heating Tooling Provided on the Vibration Dimpling Machine which is Illustrated in Fig. 6

Ten rivets are driven and checked closely for quality. By observing whether or not the "Tempilaq" melts, the set-up man can readily determine whether the work is being correctly heated.

"Tempilstik," a crayon that melts at a predetermined temperature, is also used for measuring the temperature in some operations, particularly those performed with the portable equipment described later. "Tempilaq" and "Tempilstik" are products of the Tempil Corporation, New York City.

For dimpling pre-drilled, burr-free holes, a battery of Chicago Pneumatic dimpling machines is used. Conduction heating alone is employed in such operations, since the manner in which

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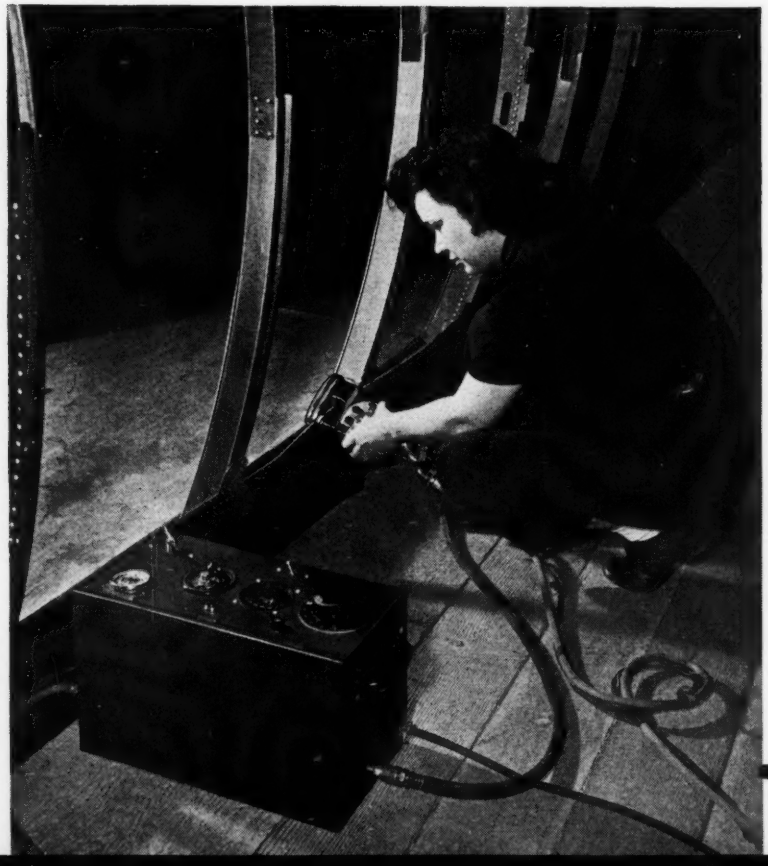

Fig. 8. Portable Equipment has been Developed to Enable Hot Dimpling Operations to be Performed on Assembled Aircraft Structures in the Shop or in the Field

Fig. 9. Another Application of the Automatically Controlled Portable Hot Dimpling Equipment in which a Bell Bar and Square-block Capacitor are Used

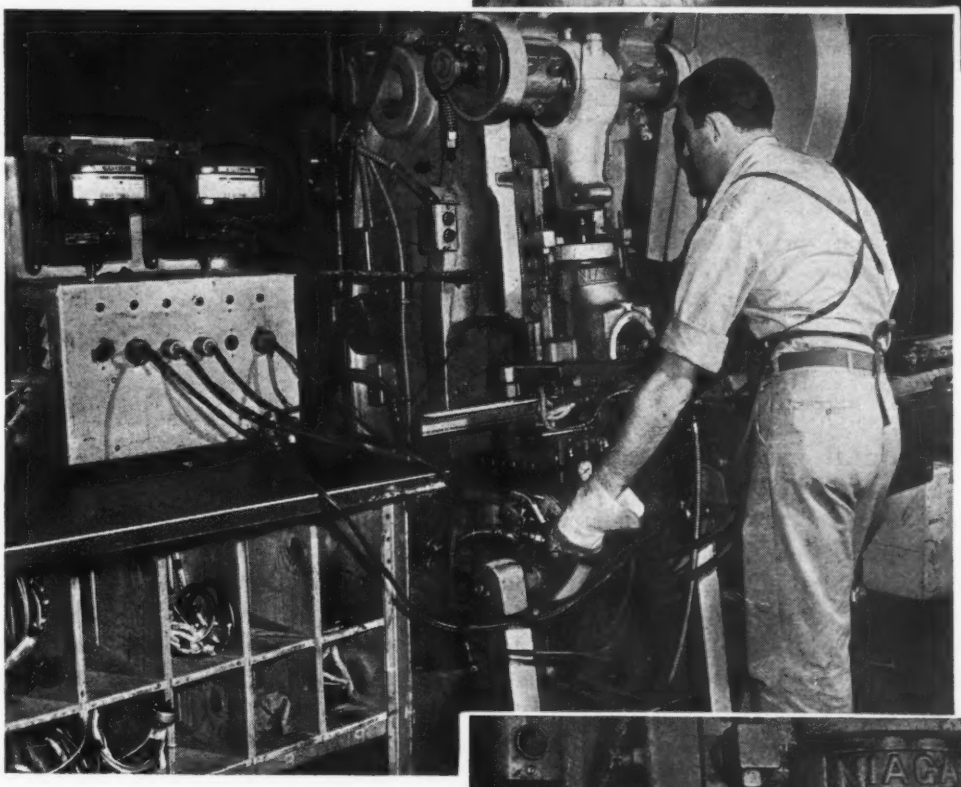

Fig. 10. Joggling Operations are Performed Hot on Rolled or Extruded Shapes of 75S-T Aluminum Alloy on the Punch Press Here Shown

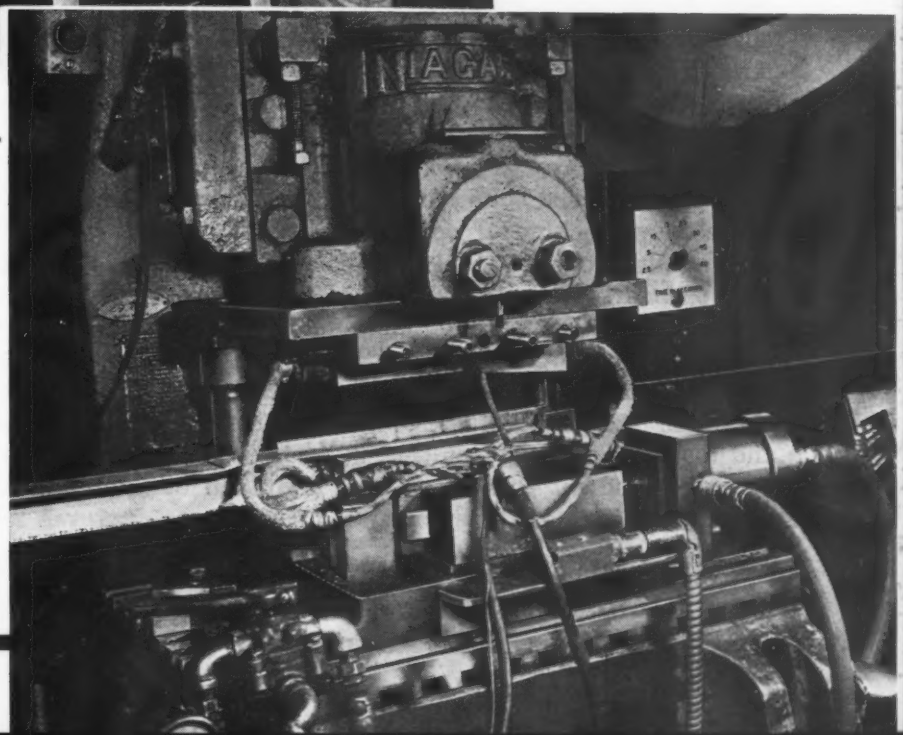

Fig. 11. The Punch Press Die Members, Both Top and Bottom, are Maintained at 500 Degrees F. for the Performance of Joggling Operations on Extruded or Rolled Shapes

Cylinder Production for the "Wasp Major" Engine

Production Methods of Machining Forged Aluminum-Alloy Cylinders at Pratt & Whitney Aircraft. Multiple-Station Transfer and Special Finning Machines are Features of This Production Line

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MORE powerful aircraft engines, operating with increased efficiency and dependability, are the constant goal of the Army, Navy, commercial air lines, and engine manufacturers. Substantial progress toward this end has resulted from the development of the "Wasp Major" engine by Pratt & Whitney Aircraft. Developed during the war, this twenty-eight-cylinder, 3500-H.P. radial engine is now being turned out on a mass production basis for use in new military and commercial aircraft.

The twenty-eight cylinders of the "Wasp Major" engine are an advanced development of previous designs. Cooling fins of increased depth are closely machined from a solid 18S-T aluminum-alloy forged cylinder head, as shown in Fig. 1, insuring maximum heat dissipation. A finned muff, also an aluminum-alloy forging, helps to dissipate the heat from the steel cylinder barrel that forms the bore of the cylinder assembly. The fin spacing at the junction of the head and muff is uniform, resulting in an even temperature gradient from the top of the cylinder head to the base of the cylinder muff. The use of a forged head, with its consequent increase in strength, awaited the development of production machining methods, whereby the fins could be formed at a rapid rate. The high-production methods employed at the Pratt & Whitney Aircraft Division of United Aircraft Corporation, East Hartford, Conn., in finning and other operations on these cylinders are described in the following.

After location holes have been drilled and reamed in the flange of the cylinder heads, the heads are assembled individually on master location plates and loaded into the fixtures of the Foote-Burt multiple-station transfer machine shown in Fig. 2. An operator locates and clamps a cylinder head in the fixture, as shown at the left in Fig. 3, after which the machine automatically transfers the loaded fixture to the next station.

This rectangular-shaped machine, approximately 20 feet wide by 28 feet long, has a pair of tracks on each of its four sides. A transfer bar between each pair of tracks carries dogs that index the fixtures to the various stations. The fixtures slide on hardened and ground track

rails. A hydraulic cushion stops the fixture at each station, after which it is locked in place.

Sixteen spindles are arranged horizontally, vertically, and at various angles on three of the four sides of this machine. Valve guide holes and seat inserts, spring pockets, and intake and exhaust ports are rough-drilled, counterbored, or faced in this operation. The tools revolve at about 200 surface feet per minute and are fed at from 1 1/2 to 7 inches per minute.

Three operators are used to load, unload, and maintain the machine, and the total production is forty cylinder heads per hour. The cycle of the machine depends upon the longest operation, which is performed at Station 5, where the throat and seat insert of the exhaust port are machined with a stepped counterboring tool, the time required being 1 1/2 minutes. The stepped counterbore, 2.250 and 2.750 inches in diameter, is revolved at 450 R.P.M. and fed at 4 inches per minute. The tool is rapidly advanced to the work at the rate of 300 feet per minute, and returned to its original position at 370 feet per minute. An intermittent feed, by means of which the tools are periodically withdrawn to allow the coolant to wash away chips and then fed in again to finish the cut, is employed at several of the stations.

The cylinder heads, still mounted on the master location plates, are next placed on special four-spindle Cincinnati Hydro-Tel machines, where the fifteen irregular contour, upper fin grooves are climb-milled. The groove widths are 0.102 inch, and the fins are 0.038 inch thick. A step is machined on one side of each fin, increasing the thickness of the fin at its base to 0.054 inch. The maximum depth of cut taken, in forming this group of fins, is about 2 1/8 inches.

Four of the cylinder heads are placed vertically in fixtures on the table of each milling machine, and are accurately aligned with the vertical spindles by pins on the fixture which enter reamed holes in the location plates. A stack of varying contour templets, mounted on the right-hand side of the milling machine table, as seen in Fig. 4, control the form of each fin by actuating a tracer roller that imparts horizontal movements to the spindles as the table is fed transversely. Coolant is flooded on the tools in this operation to prevent abrasive action.

The finning cutters, which are 6 1/2 inches in diameter by 0.102 inch thick, and contain eight

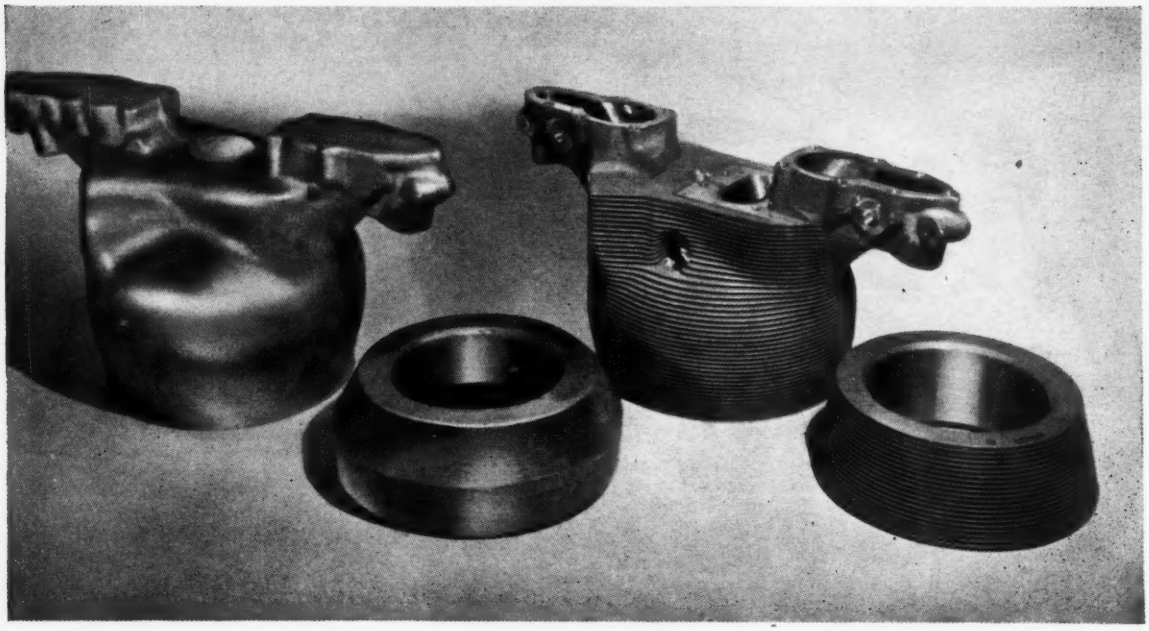

Fig. 1. Forged Aluminum-alloy Cylinder Head and Cylinder Muff for the "Wasp Major" Airplane Engine, before and after Machining

Fig. 2. Multiple-station Transfer Machine with Sixteen Spindles that Drill, Counterbore, and Face Various Parts of the Cylinder Heads

Fig. 3. Close-up View of the Loading and Unloading Stations of the Automatic Transfer Machine Shown in Fig. 2

Fig. 4. Close-up View of the Right-hand Spindle of a Special Four-spindle Finning Machine, Showing the Templets at the Right which Control the Path of the Finning Cutters

Fig. 5. The Cylinder Heads are Rotated on Auxiliary Power-driven Tables of a Special Four-spindle Milling Machine to Form the Twenty-nine Circular Fins on Each Head

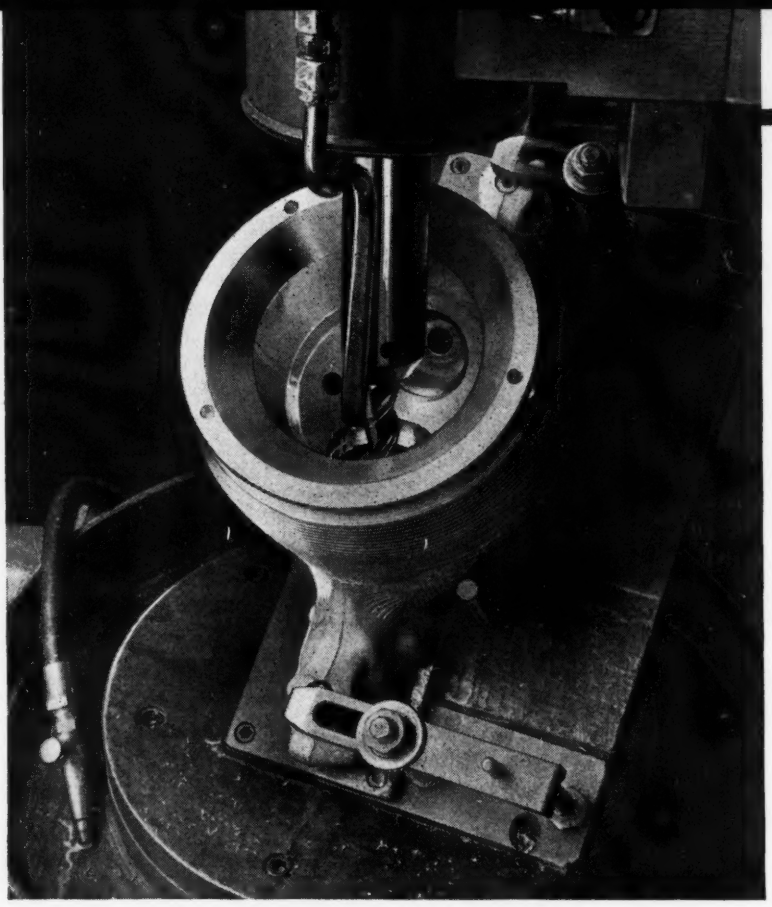

Fig. 6. The Throats of Cylinder-head Intake and Exhaust Ports are Milled on a Special Profiling Machine

carbide-tipped teeth, are revolved at 2000 R.P.M. The milling machine table feeds the heads past the cutters at the rate of 42 inches per minute, resulting in a chip load of 0.0055 inch per tooth. Four of the teeth, forming the outside diameter of the tool, cut the groove to depth, and the other four teeth reduce the thickness of the fin for about half its depth, forming the required step.

The cutters consist of a Meehanite cast body with aluminum-cutting grade, carbide-tipped teeth, normalized and ground with a 15-degree rake and a 10-degree tip clearance. The Meehanite body, due to its fine distribution of graphite, minimizes vibration and deadens sound. Previously used steel bodies were quite noisy when rotating at the relatively high surface speed of 3400 feet per minute. The life of these finning cutters between grinds is about fifteen cylinder heads, and has been lengthened 33 per cent by changing from a six- to an eight-tooth cutter on this particular operation. The table feed, which was originally 11 inches per minute, has been increased almost 400 per cent.

After finning one side of the four cylinder

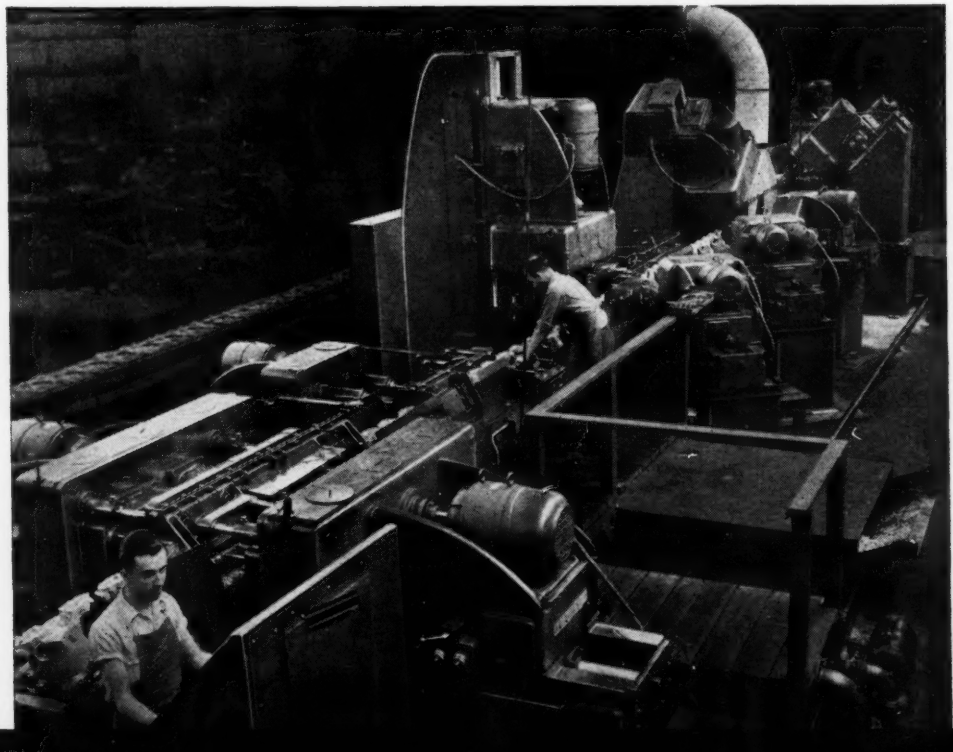

Fig. 7. Straight-line Transfer Machine, 62 Feet Long, in which the Cylinder Heads are Drilled, Reamed, Counterbored, Spot-faced, and Tapped

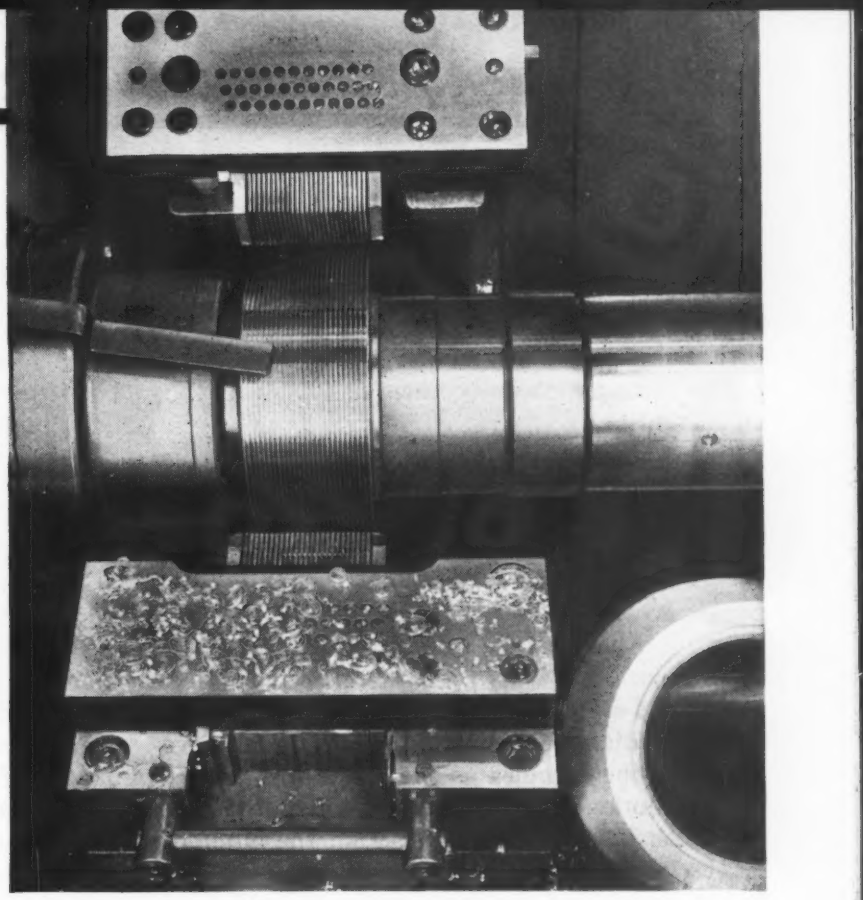

Fig. 8. Close-up View of Tooling Employed on the Automatic Lathe Shown in Fig. 9 for the Second Finning Operation on the Cylinder Muffs

heads, the machine automatically indexes the heads through an angle of 180 degrees and mills the opposite sides. Eight heads are finned per hour in this operation. Snap gages, width gages, and indicator calipers are employed to check the fin and groove widths and the depths of the grooves.

Following the finning operation, the location plates are removed from the cylinder heads, and the throats of both intake and exhaust ports are finish contour-milled on special Snyder profile machines, such as the one shown in Fig. 6. The head is mounted on an angular fixture which allows the vertical spindle and tool to enter the port being machined. The vertical head, in which the cutter-spindle is rotated, remains stationary after it has been lowered to the cutting position, and the required contour of the throat is obtained by movement of the fixture and the table of the machine. As the fixture is rotated, the table is moved vertically by means of a cam in the base of the machine.

A high-speed steel, two-fluted end-mill, 0.908 inch in diameter, is rotated at 2400 R.P.M. and

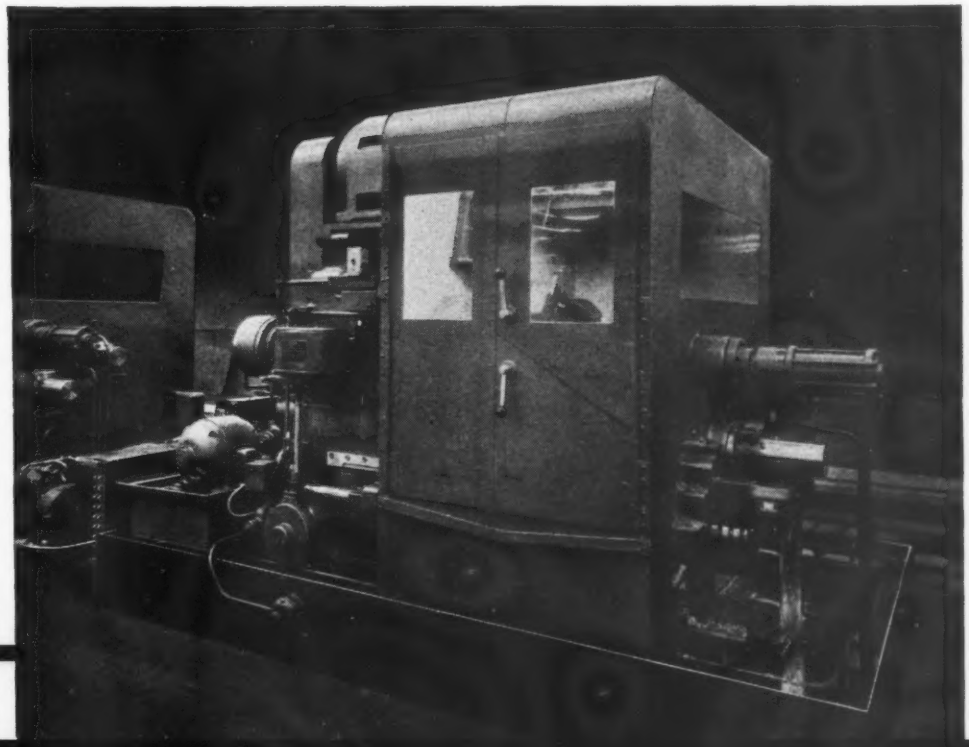

Fig. 9. Forged Aluminum-alloy Muffs are Finned in Two Operations on Automatic Lathes with Gang Tools on Both Front and Rear Tool Arms

fed at the rate of 0.001 inch per revolution for this operation. One man operates two machines, and completes fifteen pieces per hour. Contour gages, located from the face of the cylinder-head flange, are used to check the diameter and depth of the throats.

The remaining twenty-nine fins, which are circumferential, are now climb-milled on special Cincinnati four-spindle Hydro-Tel milling machines similar to those previously described for forming the fifteen elliptical fins. In this operation, the head is held on the faces of its two rocker boxes in a fixture secured to an auxiliary, power-driven rotary table, as shown in Fig. 5. Four of these rotary tables are mounted on the main horizontal table of each milling machine. A stack of circular templets having various contours and diameters control the horizontal movements of the spindles as the heads are rotated.

The finning cutters used in this particular operation have six teeth, three on the outer diameter and three on the step-cut diameter. The cutter speeds are the same as for the elliptical-fin forming operation. The stack of templets and the four cylinder heads are all rotated at 1.5 R.P.M. The table is traversed at the rate of 24 inches per minute, resulting in a production of about 4 1/2 heads per hour.

After sand-blasting to remove burrs from the fins, heat-treating, and performing several conventional machining operations, the heads are again mounted on location plates and passed through a sixteen-station, ten-spindle Foote-Burt transfer machine similar to the one previously described. Here the valve guide holes, valve seat recesses, and exhaust ports are finished at the rate of forty heads per hour.

Still assembled on their location plates, the cylinder heads next pass through the Greenlee thirty-eight-station, straight-line transfer machine seen in Fig. 7. Here the rocker-box stud-holes, thermo-couple holes, spark-plug openings, and intake- and exhaust-port stud-holes are drilled, reamed, counterbored, spot-faced, countersunk, and tapped by seventeen heads with a total of 101 spindles set horizontally, vertically, and at various angles along the 62-foot long line.

The locating plates, each holding a cylinder head, are automatically transferred from station to station, and are clamped and unclamped at each station, being held in position during machining by locating dowels. Four operators—one loading, two inspecting, and one unloading—produce forty-five cylinder heads per hour. The transfer cycle is limited by the operations performed at Station 16, where a 9/32-inch diameter deflector hole is drilled through the outer end of the intake rocker box and two 1 1/2-inch diameters on the exhaust port pad are spot-faced; these operations require about 1 1/4 minutes. At Stations 9 and 15 the alignment of the two rocker-shaft holes, and all holes to be tapped, are checked automatically, the machine stopping if the hydraulically actuated pins cannot enter the holes to the required depths.

The muff, which provides cooling fins on the "Wasp Major" cylinder below the cylinder head, is an aluminum-alloy forging, as previously stated. Its outside diameter and bore are rough-turned on a Bullard Mult-Au-Matic. Twenty-one

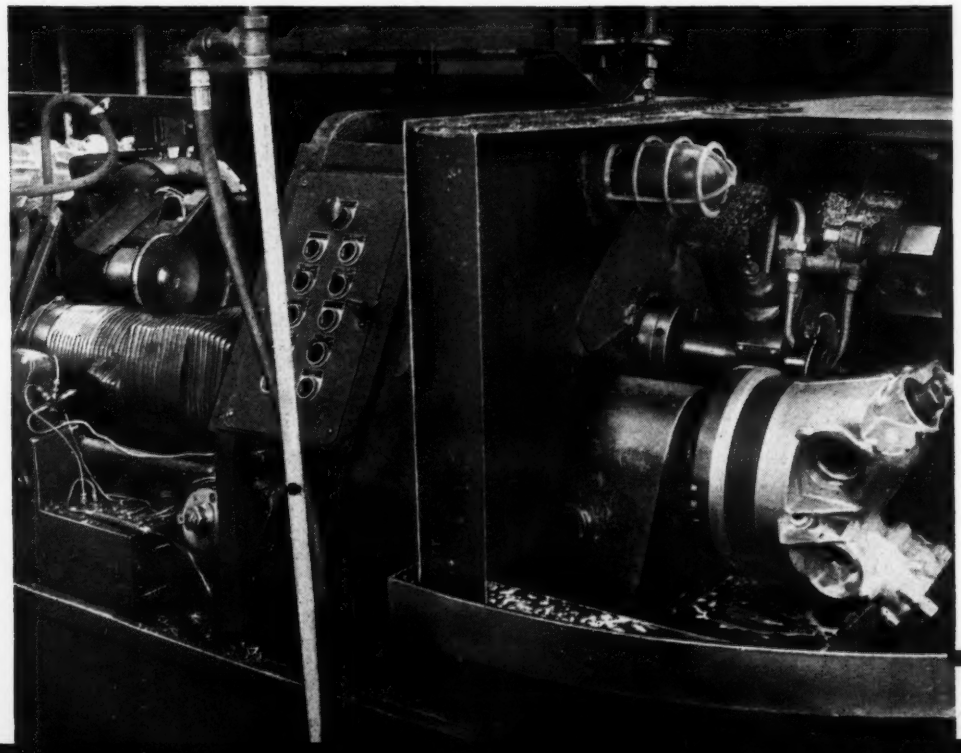

Fig. 10. Another Type of Cylinder Head is Finned on This Automatic Machine, in which the Common Cam and Work-shaft is Advanced when the Cutter Recedes from the Work

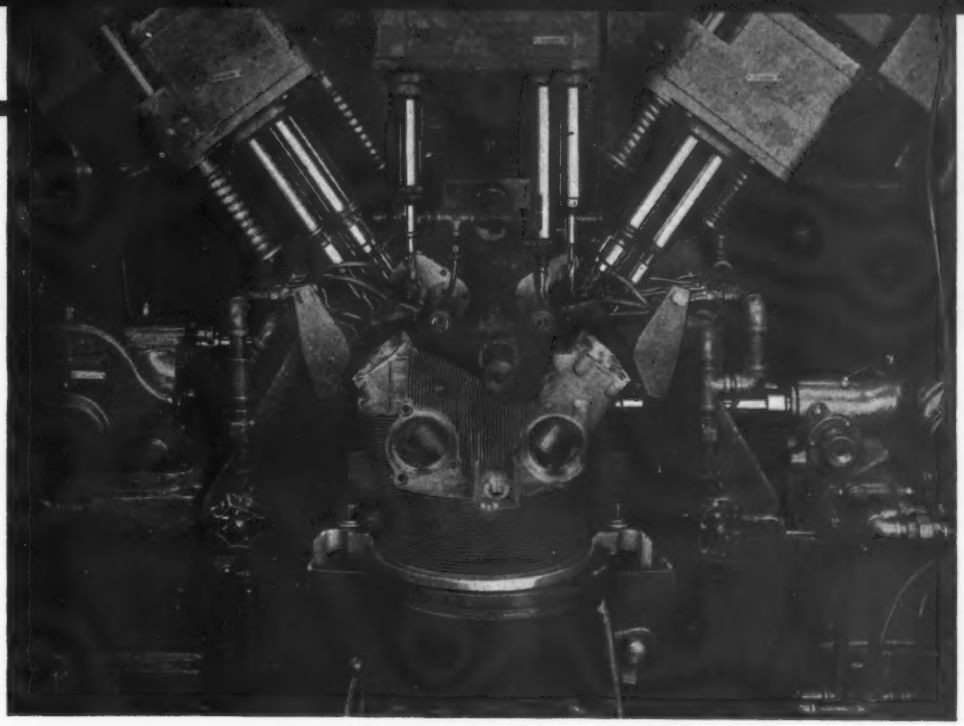

Fig. 11. Multiple-operation Machine Employing Twenty-five Spindles on Six Heads to Countersink, Counterbore, Spot-face, and Tap Holes in the Cylinder Heads

fins are then formed on the periphery in two operations on special Fay automatic lathes, such as the one shown in Fig. 9.

In the first finning operation, fourteen carbide-tipped cut-off tools are mounted in the front tool-block and twenty in the rear tool-block. The work is located on an expanding arbor chuck that rotates it at 245 R.P.M. First the tools in the front block enter the work, forming the largest-diameter top fin to a depth of about 1/2 inch. The tools are staggered in the blocks to form the required contour of the fins. The tools in the rear block enter the work slightly behind the front tools, and do not begin to cut until the front tool-block has been retracted. The rear tools increase the depth of the grooves about 3/8 inch and form steps on one side of each fin. Both front and rear tools are fed into the work at the rate of 0.0025 inch per revolution.

The second finning operation, a close-up view of which is shown in Fig. 8, is similar to that just described, except that twenty tools are located in both front and rear tool-blocks. Also, the increased rigidity caused by the tools cutting deeper in the work permits the work speed to be increased to 326 R.P.M. and the feed to 0.0035 inch per revolution. The front tools increase the groove depths by 3/8 inch, and the rear tools by 1/4 inch. One man operates two machines and completes nineteen muffs per hour.

After burring, degreasing, anodizing, and finish-turning the locating hub and bore, the muffs are ready for shrink fitting onto the steel cylinder barrels. The muff is heated to 550 degrees F. in an electric oven, and placed on the cylinder barrel against a spacer ring gage. The assembly is submerged in a bath of non-rusting liquid, maintained at room temperature, and is held there until the muff shrinks the required amount.

Another interesting finning job is performed on the cylinder heads of the Pratt & Whitney Aircraft R-2800 "Double Wasp" engines. The eleven circular fin grooves and thirty-three contour fin grooves of these heads are cut, one at a time, in a single set-up on the special Sundstrand fin milling machine seen in Fig. 10. The cylinder head and forty-four contour cams are mounted on the same arbor and rotated at one revolution per minute. A 6 1/2-inch diameter, eight-tooth, carbide-tipped finning cutter, mounted on the same arm as the cam follower, is rotated at 3500 R.P.M., and fed into the work hydraulically at a rate varying from 37 to 57 inches per minute, depending upon the distance of the cutter from the center of the work. This variable feed rate, accomplished by means of an automatic clutch in the cutter driving mechanism, gives a chip load of from 0.0026 to 0.0041 inch per tooth. When the cutter recedes from the work, the cylinder head is indexed forward a distance equal to the center distance of the fins. One operator runs two machines and produces about 3 1/2 heads per hour.

A multiple operation performed on the same type cylinder head is shown in Fig. 11. Here twenty-five hydraulically actuated spindles, on six heads, are used to countersink, counterbore, spot-face, and tap various holes in the work, completing forty-one cylinder heads per hour.

Flash-Welding Tubular and Solid Parts for Lockheed Planes

The Technique Employed in Permanently Joining Alloy-Steel Members by Welds that Must be 95 Per Cent as Strong as the Parent Metal

By FRED C. PIPHER
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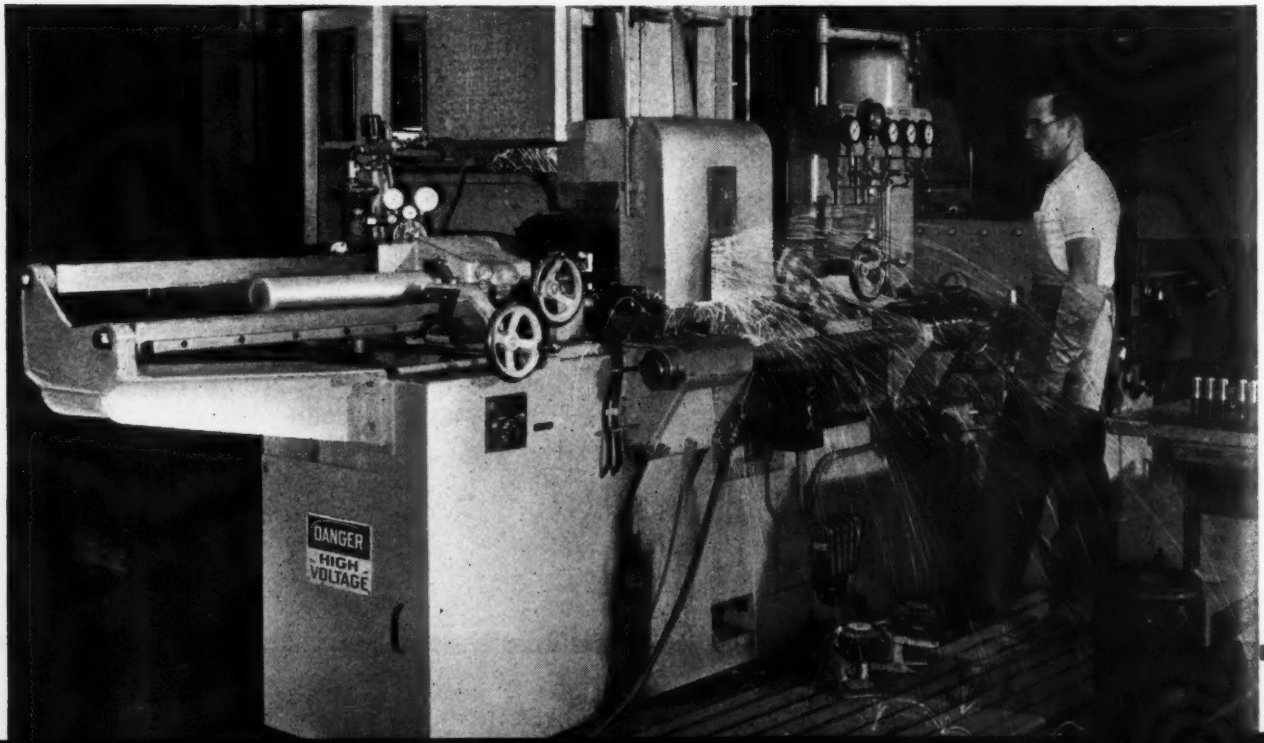
FLASH-WELDING has been applied for some years by the automotive and allied industries, but was not adopted until recently by airplane manufacturers. However, with the development of improved equipment, and especially with the availability of automatically controlled and hydraulically operated flash-welders that insure high-quality joints in steels of the types used in aircraft construction, plane manufacturers, in the latter days of the war, turned to this method. The excellent results obtained insured a continuation of the application of this method of welding to peacetime production.

In flash-welding, two metal shapes of similar cross-section are placed in line and retained in position by copper dies or clamps. The two parts are then brought slowly together, and upon contact, a low-voltage, high-amperage current flows through the parts rapidly heating the points of contact. The molten metal at the point of contact is expelled causing a flashing action. It is from this phenomenon that the method derives its name. During the flashing cycle, the ends of

Fig. 1. A 200-K.V.A. Flash-welding Machine Engaged in Flash-welding a Hub Assembly for Airplane Rudders. A Close-up View of This Operation is Illustrated in Fig. 3



both parts are heated to the proper welding temperature. End pressure is then applied to complete the welding operation.

At the Lockheed Aircraft Corporation, Burbank, Calif., the welding is done in an atmosphere of argon gas to eliminate the oxide type of defect which results from flashing craters and oxidation of the flashing surfaces on the metal parts being joined. During the welding cycle, argon gas is delivered by tubing and directed around the flashing surfaces. In the case of tubular assemblies, argon gas is carried through the tube itself and permitted to escape over the flashing surfaces. It completely envelops the parts in this area, excluding oxygen from the molten surfaces.

A considerable variety of parts, including landing-gear cylinders and pistons, drag struts and elevator torque fittings, and control rods, are produced by flash-welding in the Lockheed plants. On some planes, the landing-gear parts are 100 per cent flash-welded. Steels in a heat-treated condition with tensile strengths ranging from 125,000 to 145,000 pounds per square inch are satisfactorily flash-welded.

Fig. 2 shows a group of typical flash-welded parts, including, from top to bottom, a main landing-gear side strut, an engine control-rod assembly, a V-brace down lock for a nose landing gear, a push-rod for the elevator tab, and a nose landing-gear down-lock guide. In Fig. 5 are seen flash-welded hub assemblies for the rudder of the Constellation transport plane.

Welding machines of various capacities, as high as 200 K.V.A. and as low as 20 K.V.A., are regularly employed in this shop. Shapes having a cross sectional area as large as 3 square inches are flash-welded together. Wall thicknesses down tc a minimum of 0.035 inch are welded. On tubular parts, it is of the utmost importance that the ratio between the outside diameter of a section and the minimum wall thickness does not exceed 30 to 1.

While the flash-welding method is generally employed at Lockheed for joining parts of tubular cross-section, it is sometimes used on solid stock. In fact, sheets and plates have been welded together satisfactorily. On such work, a bevel is provided on one of the parts, a double bevel being used on plates over 0.188-inch thick. On solid square or round stock, bevels are necessary on the abutting ends of both parts.

Misalignment of tubular parts after welding must not exceed 10 per cent of the wall thickness or 0.020 inch, whichever is less. On solid bars, the misalignment must not be greater than 5 per cent of the stock diameter or width. The materials welded together are generally NE 8630, NE 8735, NE 8740 and S A E 4130, 4140, and 4340 alloy steels.

Before acceptance for use on an airplane, every critical welded part is proof tested to a specified percentage of the ultimate strength of the alloy steel from which it was produced. Welding specifications are established based on

Fig. 2. Variety of Parts Made up by Flash-welding Two or More Steel Pieces Together, for Installation on Lockheed Constellation Transport Planes

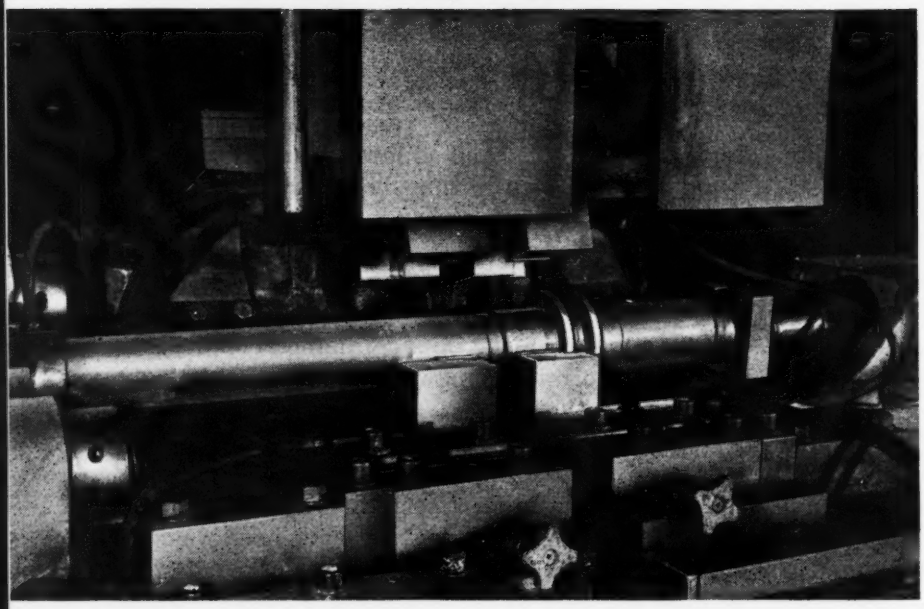


Fig. 3. The Two Parts that Make up the Rudder Hub Assembly Shown in Place in the Dies of the 200-K.V.A. Welding Machine, Ready to be Joined Together

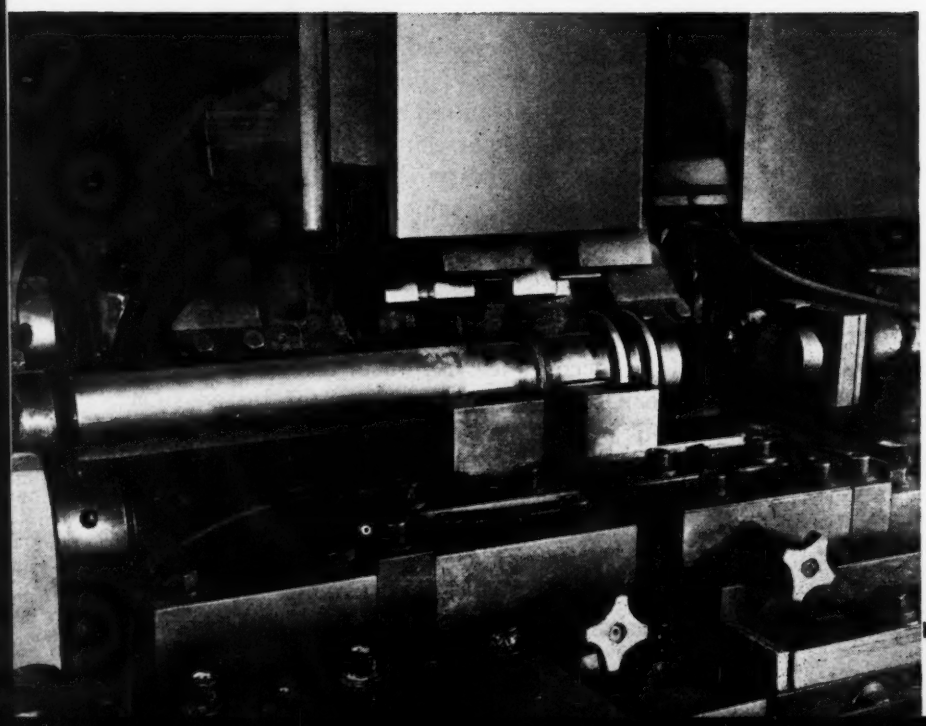


Fig. 4. At the Completion of the Operation on the Rudder Hub Assembly, the Die-blocks Open Automatically and the Slides of the Machine withdraw to Facilitate Removal of the Finished Job

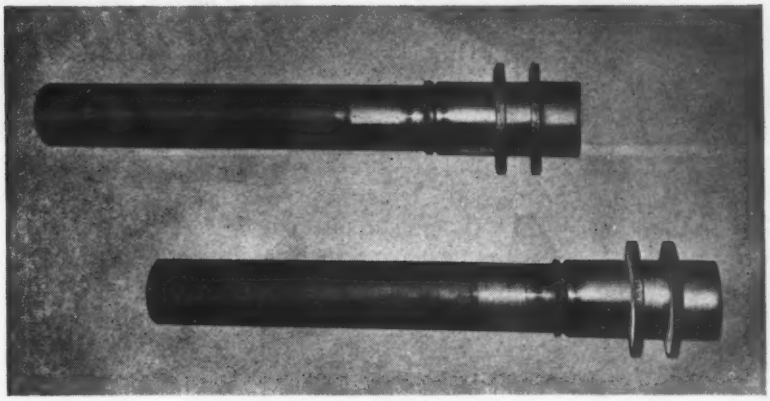


Fig. 5. Hub Assemblies for the Rudder of the Constellation, the Parts of which are Joined Together by Flash-welding

destructive strength tests. Methods specified must consistently produce welds which are at least 95 per cent as strong as the parent metal. In addition to strength tests, all parts are inspected for defects by the Magnaflux process. In actual production, rejections of welded parts have been less than one-tenth of one per cent. Normalizing component parts prior to welding is not necessary.

Fig. 1 shows a National Electric 200-K.V.A. machine engaged in flash-welding a hub assembly for the rudder of the Constellation. A close-up view is shown in Fig. 3 of the parts that make up the rudder hub assembly, prior to the welding operation. Fig. 4 shows the flash-welded assembly at the end of the operation, with the hydraulically operated platen and clamps of the machine opened to permit removal of the work-piece.

In this operation, the application of the current is accurately controlled through cam-operated limit switches and ignitron contactors. The dies are automatically closed on the work prior to the operation and opened when it is completed, both movements being effected by hydraulic pressure. The platen that carries the right-hand part of the assembly is also hydraulically controlled by a cam-operated valve. A force of approximately 58,000 pounds is available for forcing the fused ends of the two parts together. The hub assembly parts are 3 inches outside diameter and have a wall thickness of 0.250 inch. They are both made of S A E 4130 steel.

Two flash welds are made on the main landing-gear drag struts shown in Fig. 6. The illustration shows one of the struts with the first flash weld completed and the parts in the dies of the 200-K.V.A. machine, ready for making the second flash weld. The welded sections on these struts are 3 inches in diameter and have a wall thickness of 0.219 inch. These parts are made of two NE 8735 steel end fittings joined to S A E 4130 steel tubing at a production rate of twelve assemblies per hour.

A typical operation on a Taylor-Winfield 50-K.V.A. butt flash-weldng machine is shown in the heading illustration. This consists of joining pieces of the link-assembly main landing-gear door mechanism for Constellation planes. The pieces joined are tubing of S A E 4130 steel, 3/4 inch outside diameter, with a wall thickness of 0.049 inch. The parts are joined at a production rate of 180 per hour.

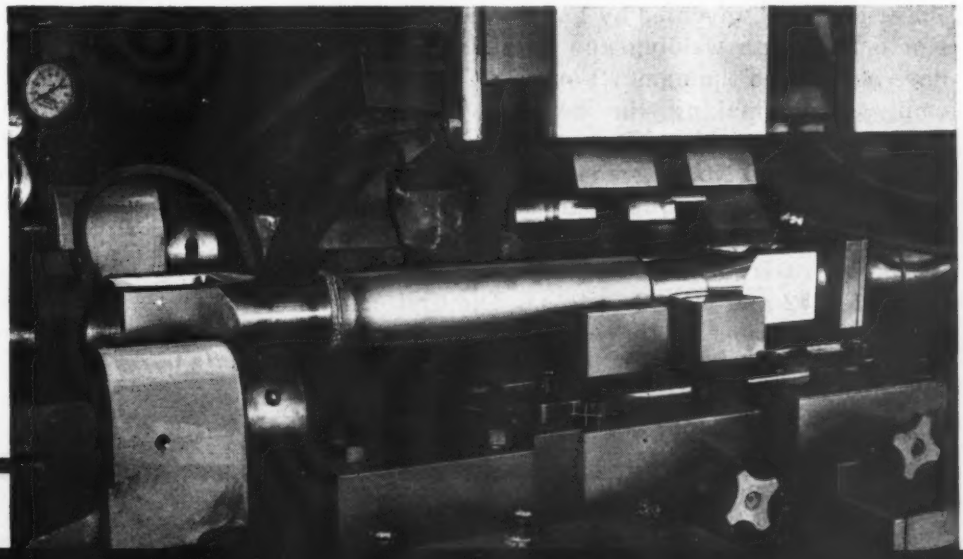
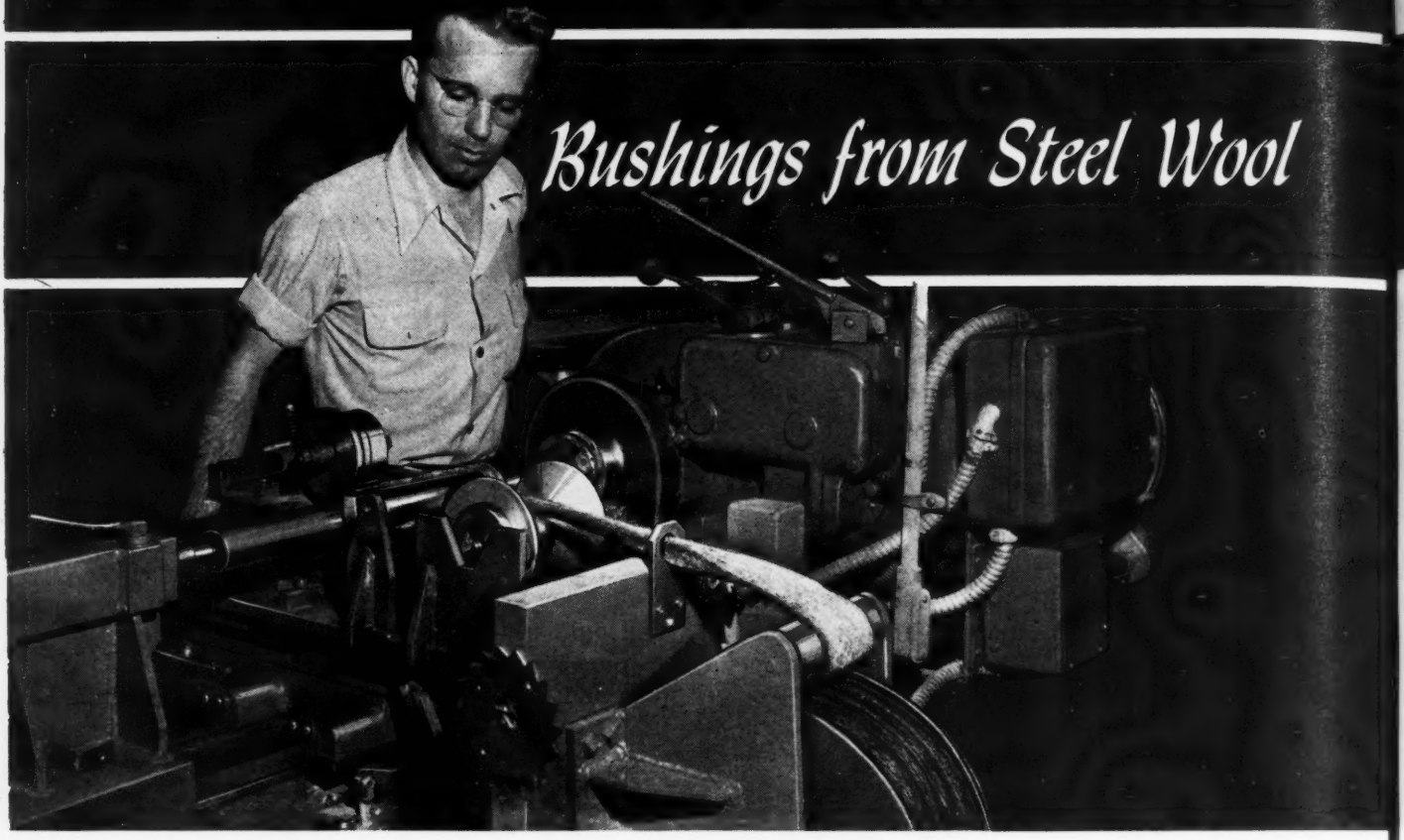


Fig. 6. The Three Parts that Make up the Main Landing-gear Drag Strut of Constellation Transport Planes are Joined Together in Two Flash-welding Operations

Bushings from Steel Wool



These Unique Bushings are Impregnated with Copper Completely throughout Their Structure, and at the Same Time, are Assembled by Brazing into Landing-Gear Struts

By CHARLES O. HERB

MANUFACTURING economies and improved bearing service have been achieved by North American Aviation, Inc., Inglewood, Calif., through the adoption of bearings made of steel wool for use in the landing-gear struts and other parts of the NAvion personal airplanes. After the bearings have been formed from steel wool, they are impregnated with copper throughout in a furnace operation which gives, in effect, porous copper bearings. These bearings, invented by Lawrence H. E. Fox, North American welding and brazing engineer, have been given the name "Foxite." The process employed in making the bearings has been registered in the U. S. Patent Office.

Steel wool of No. 3 grade is received at the plant in rolls weighing approximately 15 pounds. Specifications require that a 54-foot length of ribbon taken from one of these rolls weigh between 13 1/2 and 14 1/2 ounces. The first step in the production of the bushings consists of annealing the roll of steel wool, so as to eliminate its springiness and allow firm packing in the following operations. The annealing is performed in a General Electric atmosphere-controlled furnace, operated at a temperature of 2100 degrees F., the wool being held in the heating zone for about three minutes. It is then gradually advanced through a water-cooled chamber, approximately 18 feet long, which is maintained at a temperature of between 120 and 130 degrees F. The entire annealing process takes about forty minutes.

The annealed wool is placed on a spool for the first step in forming the bearings, and as the roll is compressed somewhat to make it small enough to enter the annealing furnace, it is necessary to open up the center of the roll sufficiently to permit the hub of the spool to enter it. This is done by inserting a large wooden conical plug into the hub, after the plate has been removed from one side of the spool, and working the conical plug

into the steel wool until the cylindrical hub of the spool can be pushed through the roll. The conical plug is then removed from the spool and the plate replaced, after which the spool is ready for use.

The spools of steel wool are mounted on the rear of a lathe, as illustrated in Figs. 2 and 3. A ribbon of steel wool about 3 inches wide is drawn up over a taped measuring roll just above the spool. The ribbon is then passed through an opening in the bracket at the back of the lathe bed and then over a V-type roller. The opening in the bracket and the roller start to gather the steel wool of the ribbon together, so as to form a more compact ribbon. This gathering is completed by finally threading the ribbon through a slot 1 inch long by 5/16 inch wide in a steel block mounted on the carriage, as seen in Fig. 2.

After the ribbon has been pulled through this block, the end is attached to a dog at the left-hand end of an arbor which is held between the headstock and tailstock of the lathe. Then, when the lathe is started, the arbor draws the steel wool from the spool, as seen in Fig. 4. The carriage is fed to the right in synchronism with the rotation of the arbor, the ribbon of steel wool being tightly wound on the arbor and overlapped about three-fourths of its width, so as to obtain a fairly compact tube of wool.

The wool is actually "laid" on the arbor at an angle by means of a curved roller mounted on the front of the carriage, as seen in Fig. 4. Beside the curved roller is a flat ironing roller which prevents the successive windings of steel wool from climbing on each other. These rollers press the steel wool firmly on the arbor. They are adjustable for any desired pressure.

The amount of steel wool to be fed on the arbor for a bearing of specified diameters and length is based on experience with various jobs, and a chart has been developed to give the lathe operator the required information. The operator also judges the amount of steel wool to be fed for any specified bearing by examining the thickness of the steel wool ribbon, as this varies somewhat. Usually, a trial bearing is run before the required length of ribbon is definitely determined.

When the necessary length of steel wool has been determined for a bearing, the amount that is fed to the arbor is controlled by means of the measuring roll at the back of the lathe bed, to which reference has already been made, and a toothed index-wheel mounted on a bracket adjacent to the measuring roll, as may be seen in Fig. 2. This illustration also shows an extra index-wheel in the foreground. One complete revolution of the measuring roll feeds three feet of steel wool, and index-wheels are available with any number of teeth from fourteen to twenty. These enable as much as 60 feet or as little as 42 feet of steel wool to be fed in an operation.

Each time that the measuring drum makes a revolution, a pin on the side of the drum advances the index-wheel through one notch. When the index-wheel has made a complete revolution,

Fig. 1. (Left to Right) Compressed Bushing of Plain Steel Wool; Steel-wool Bushing with a Coil of Copper Wire in It; Steel-wool Bushing that has been Impregnated throughout with Copper; and "Copperized" Steel-wool Bushing that has been Turned and Faced

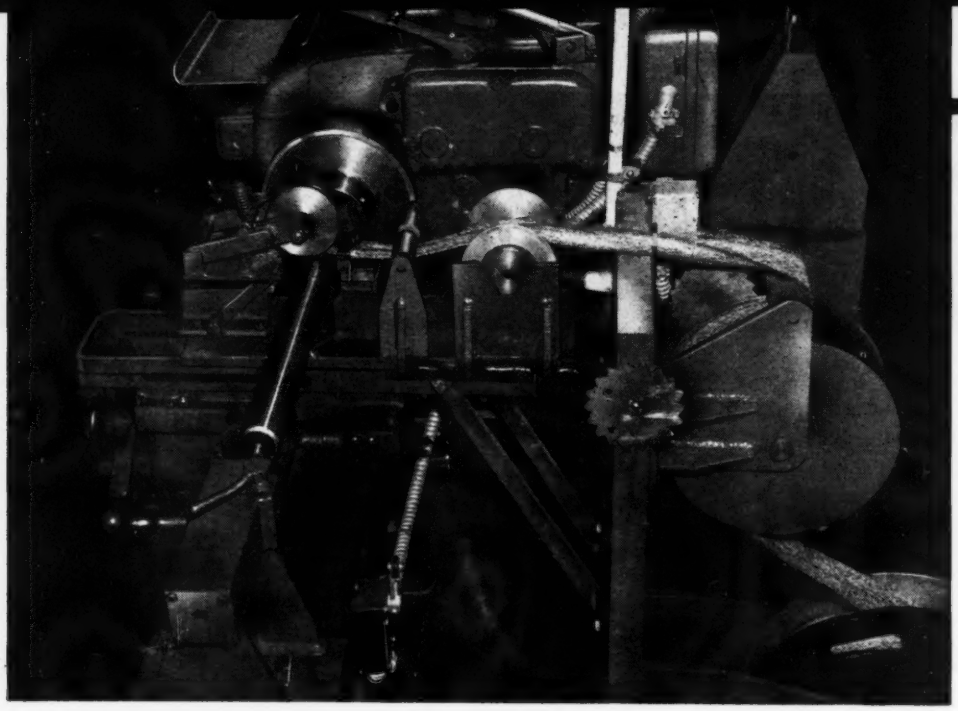
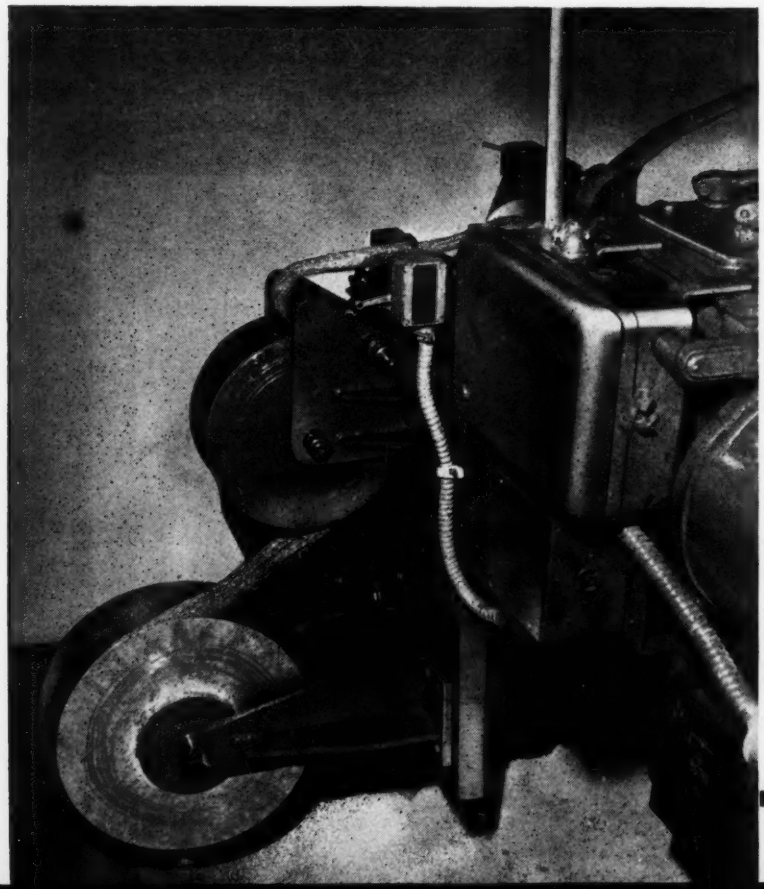


Fig. 2. (Left) Engine Lathe on which Steel Wool is Wound on an Arbor from a Spool Mounted at the Back of the Machine

Fig. 3. (Below) View Showing how the Steel Wool is Fed from the Spool up over the Measuring Roll

a stud projecting from the side of the wheel trips a limit switch, which stops the lathe motor and actuates a solenoid switch to apply a brake on the faceplate, thus immediately stopping the rotation of the arbor. This brake, which consists of a leather strap, may be seen at the left in Fig. 4. Generally speaking, steel wool is wrapped on the arbor for a length of about 18 inches. When the lathe is stopped, the operator applies a pair of shears to cut the ribbon that leads to the measuring roll.

The next step in the process is to compress the tube of steel wool to the finished length and diameters of the bushing being produced. This is accomplished on a 30-ton pneumatic press. The lathe arbor, with the steel wool, is placed vertically in a fixture mounted on the base of the press, as shown in Fig. 5. When the ram of the press is actuated, a sleeve first comes down over the arbor and steel wool, as seen in this illustration, to control the outside diameter of the bushing when the ram completes its stroke. Then, a hollow punch, as shown in Fig. 6, comes down over the arbor and into the sleeve, packing the tube of steel wool solidly between the sleeve and the arbor.



When the bushing has been compressed to the required length, say 2 1/2 or 3 inches, from the original length of 18 inches, the ram pressure is momentarily released, permitting a plate with a hole in it to be pushed beneath the compressed bushing. Further pressure exerted by the press ram forces the bushing off the arbor and allows it to drop through the hole in the plate into a compartment in the fixture, from which it is easily removed. An indicating device on the column of the press shows at all times the position of the lower end of the punch.

The copper impregnation to which reference was made at the beginning of the article is accomplished by placing a coil of copper wire, 3/16 inch in diameter, inside

FROM STEEL WOOL

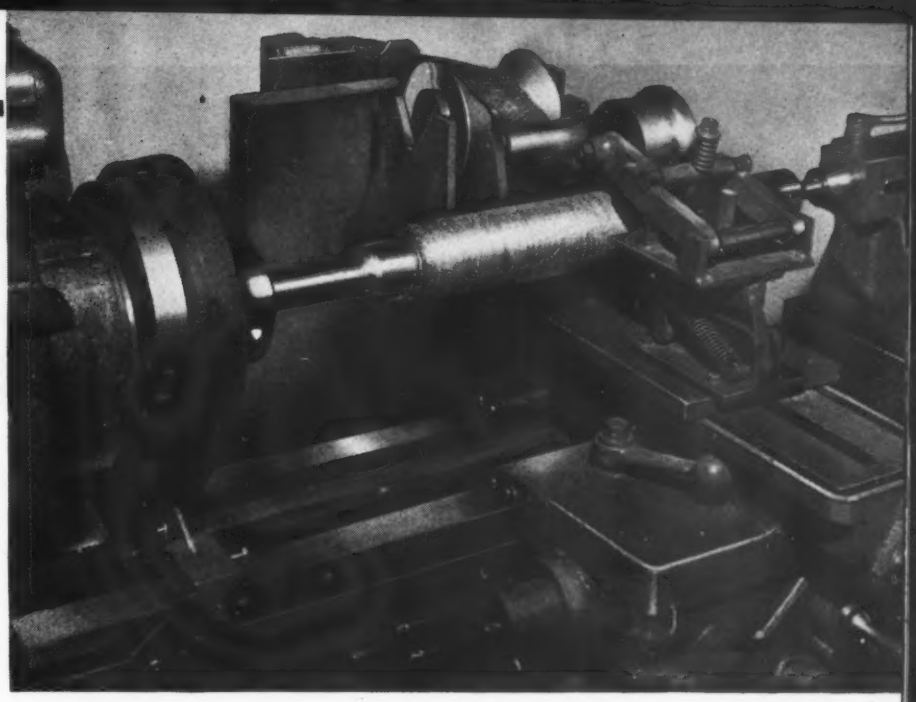


Fig. 4. (Right) View from Front of Lathe, Showing Manner in which Steel Wool is "Laid" on Arbor

Fig. 5. (Below Left) Arbor, with Steel Wool, is Placed Vertically on a Pneumatic Press for Compressing Steel Wool into a Bushing of Desired Dimensions

Fig. 6. (Below Right) Another View of Tooling in Fig. 5, Showing Hollow Punch about to Enter Sleeve that Surrounds Steel Wool and Arbor

the steel-wool bushing, as shown in the second example from the left in Fig. 1, and then placing the bushing, held vertically on a tray, into the General Electric atmosphere-controlled furnace already referred to. The furnace is operated at a temperature of about 2100 degrees F. Copper equal in weight to one-half that of the steel wool in a bushing is placed in the bushing. When the copper melts, it is drawn by capillary attraction throughout the entire structure, so that what is, in effect, a complete copper bearing is obtained.

From the heating section of the furnace, the bushings are gradually advanced through the cooling chamber in the same manner as when the original coils of steel wool are annealed. The third example from the left in Fig. 1 shows one of the bushings impregnated with copper, while at the extreme right may be seen a "copperized" bushing after being turned and faced.

In many cases, the steel-wool bushings are placed in landing-gear struts and go through the furnace in the struts, so that an assembly operation is effected simultaneously with the impregnation, the copper brazing the bushing permanently in place in the strut member. When bushings are handled individually, about two dozen are placed on a tray at one time. The operation takes twenty-five to thirty minutes.

As patent rights in this process and articles made thereby have been assigned to North American Aviation, Inc., concerns wishing to use the same have to be licensed by that company.

Precision Machining and of Aircraft-Engine

Precautions Taken by the Wright Aeronautical Corporation to Eliminate Inaccuracy and Distortion during Machining, Heat-Treating, and Casehardening of Aircraft Reduction Gears

By VALLORY H. LAUGHNER

THE aviation industry has always been weight conscious. It continuously strives for methods of decreasing weight while maintaining reliability, for less weight means more payload, a greater flying range, or both.

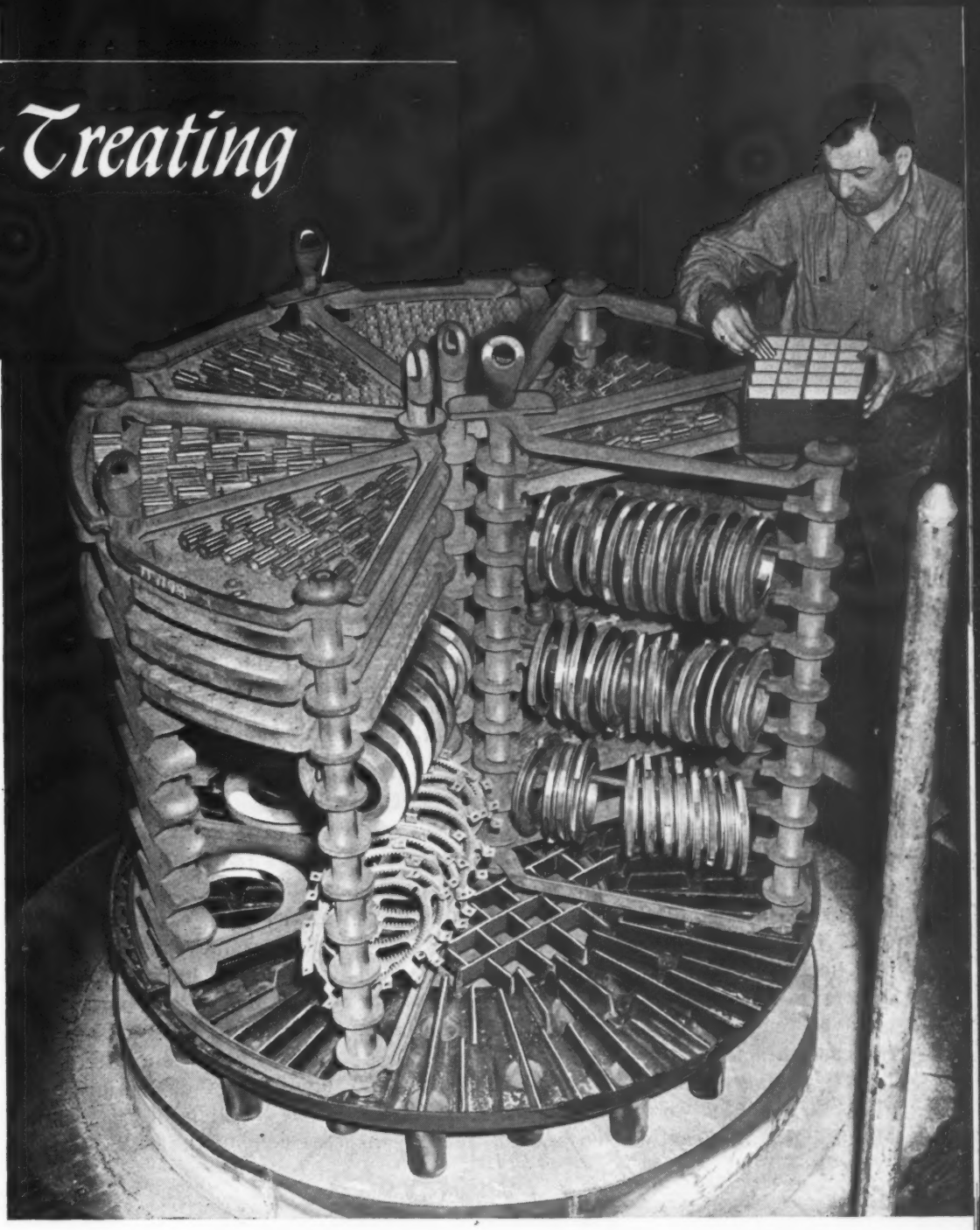
In an effort to remove enough weight from its eighteen-cylinder 2500-H.P. radial engine to increase the carrying capacity of four-engine transports by eight passengers, or to correspondingly increase their range, the Wright Aeronautical Corporation, Wood-Ridge, N.J., has concentrated on redesigning the major components, among which are reduction gear units. These new gears and pinions, having a greater number of grooves and lightening holes and less wall thickness and web area than previous designs, are more difficult to machine accurately and to heat-treat without distortion. Some typical examples of these units are shown in Fig. 1.

The precautions taken by Wright engineers to insure accuracy are applicable not only to airplane gears, but to others as well, and the same methods that are used to prevent distortion by machining stresses and subsequent casehardening can be applied to other precision parts. The practice followed may be briefly summarized as follows:

1. Incoming materials are checked for composition to determine whether they meet specifications.
2. All locating surfaces are ground true and parallel.
3. All critical parts are stress-relieved after rough-machining operations.
4. Fixtures are designed to clamp on solidly supported members.
5. Machines are tooled in such a way that the cut will not be so heavy nor the speed so great

Fig. 1. Typical Gears that have been Redesigned to Eliminate Excess Weight. The Contour of the Reduction Gear Drive (Left) Results in a Minimum Wall Thickness; the Spider Gear (Right) has Just Enough Metal to Support the Teeth and Provide Lugs for Mounting; Weight is Removed from the Center Gears by Contouring, Grooving, and Drilling Lightening Holes

Heat-Treating Gears



that excessive stresses will be set up in thin sections of the work.

6. Tooth profiles are designed to allow an excess of material at points where the metal will shrink during heat-treatment.

7. Solid plug quenching dies are used to hold parts that are subject to distortion.

8. When conditions permit, parts are made of Nitralloy steel, which is distorted a minimum amount in heat-treating and casehardening.

9. Furnace operating conditions are closely controlled during the nitriding or carburizing cycle.

10. The parts are inspected after each major operation to prevent any process from getting out of control.

Initial Machining Operations

Much of the reduction gearing is machined from Nitralloy steel, although AMS 6260 and 6250 steels also are used extensively. Nitralloy is used for those gears that are not subjected to shock loads and whose design is such that they are likely to become distorted in the furnace. Although the depth of case on nitrided parts is

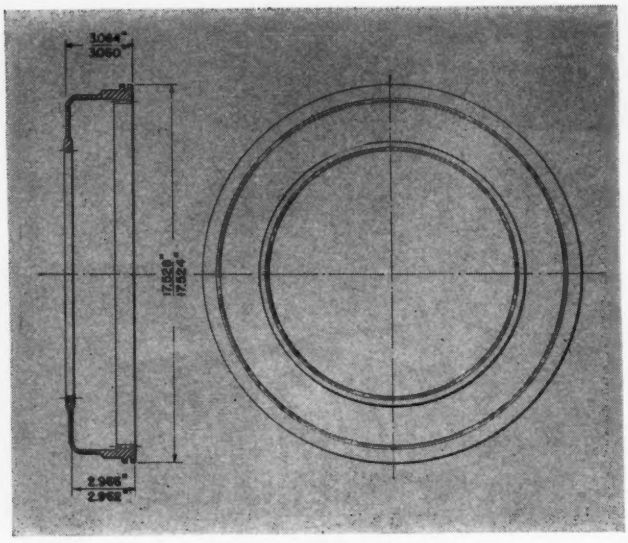


Fig. 2. Sketch of Stationary Internal Reduction Gear Blank after Finish-machining and prior to Tooth Shaping and Drilling of Lightening Holes

less than can be obtained by carburizing—a 0.017- to 0.022-inch case is obtained by nitriding, while a carburized case of from 0.025 to 0.035 inch is commonly applied to gears—this has not been found disadvantageous, provided distortion is controlled, so that the amount that must be removed by finish-machining will leave the case intact.

After being checked for composition, the forgings are routed to the shop for machining. Manufacturing practices on the stationary internal reduction gear shown in Fig. 2 are typical of the methods employed in producing gears of this size. It is first rough-machined all over on a Bullard vertical lathe; then the outside and inside diameters and the flange are finished on the Monarch lathe shown in Fig. 3, which is equipped with a contour-forming attachment.

The first cut finishes the outside flange face, the radii, and the outside diameter. The next cut, made with a form tool, finishes the lightening groove; and finally, the inside is turned. Three high-speed steel tools are mounted in the square tool-block turret, one for each operation. The contouring device has reduced machining time considerably over the previous method, which utilized an engine lathe and a grinder.

Upon the completion of this operation, the gear blank is polished, stress-relieved, finish-turned, and plated. The teeth and spline are then cut. In the past, many inaccuracies in the gear-cutting operation were due to poorly machined locating surfaces; so these surfaces are now "sparked out" on a grinder before mounting the blank on a Fellows gear-shaping machine.

The tooth cutters are designed to remove less metal than is required to form a perfect involute, allowing an excess of material at points on the tooth profile where the metal will shrink during heat-treatment and casehardening. The average drop off in a gear with forty teeth, 10 diametral pitch, and a pressure angle of 20 degrees is about 0.0006 inch. Generally, the cutters used on gears having a 20-degree pressure angle are designed with an angle of 19 degrees 40 minutes. In 90 per cent of the cases, the shrinkage in the aver-

Fig. 3. Machining the Internal Diameter and the Web of the Stationary Reduction Gear Shown in Fig. 2 on a Monarch Lathe Provided with a Contour-forming Attachment

Fig. 4. After the Teeth are Shaped, from 0.001 to 0.002 Inch is Removed from the Tooth Surfaces on Gear-shaving Machines of the Type Shown

age commercial gear is from 0.0006 to 0.001 inch. Naturally, the more roll in the tooth profile, the more drop at the tip.

Following the shaping operation, the teeth are burred so that, in the subsequent shaving operation, the cutters do not carry the burrs across the tooth face. In shaving approximately 0.002 inch is removed from the tooth surfaces on Red Ring machines, as shown in Fig. 4. The gears are then sent to the heat-treating department for hardening.

Another gear requiring close attention to detail in the manufacturing process is the spider, shown at the far right in Fig. 1. On this unit, a maximum run-out of 0.004 inch is allowed between the gear teeth and the outside diameter. Received as a solid Nitralloy forging, the spider is machined on a Hydro-Tel machine, Fig. 5. The fixture used to hold the blank provides overall support; clamping is difficult because a slight increase in pressure on one of the bolts can result in a distortion as great as 0.008 to 0.014 inch. So flexible is the blank before assembly that even brushing distorts it beyond the tolerance limits. Hence, solid supporting fixtures are specified for each machining operation, and constant-torque wrenches are used to tighten all lugs.

Practice Followed in Nitriding Aircraft-Engine Gears

As previously mentioned, gears are casehardened at Wright either by the carburizing or the nitriding process. The nitriding process is closely

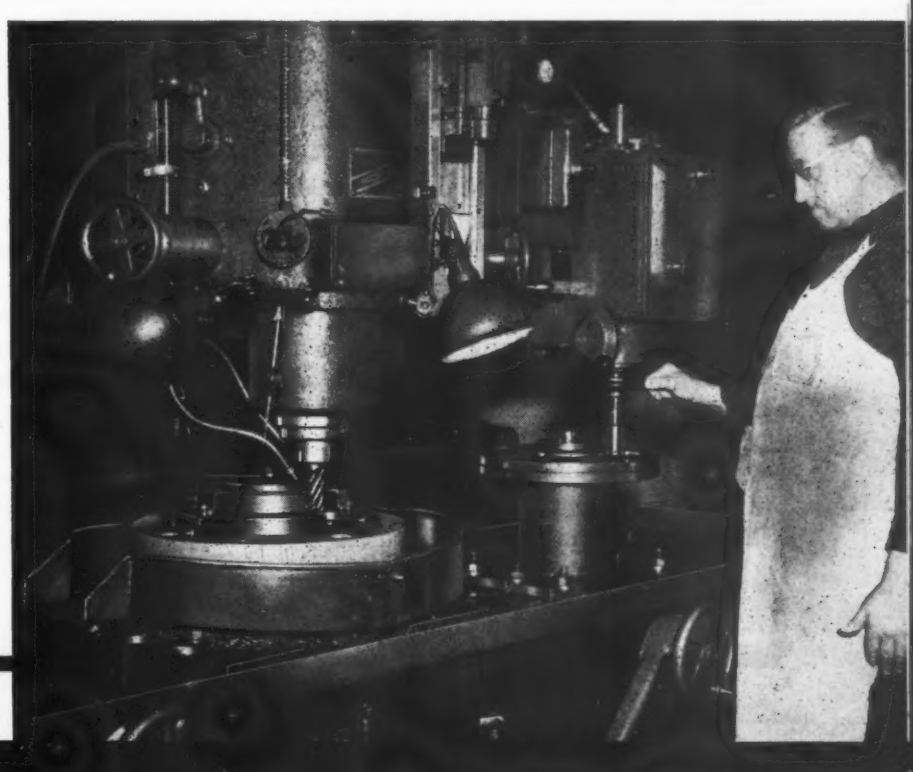


Fig. 5. A Hydro-Tel Machine is Used to Mill the Spider Gear Shown at the Far Right in Fig. 1, a Templet and Follower Arrangement Guiding the Cutter. The Cutting Oil was Stopped while This Picture was being Taken to Give a Clearer View of the Part

Fig. 6. Solid Plug Dies are Used for Quenching the Gears in Oil. The Operator is Seen Holding an Impeller Gear

controlled, so that little difficulty is experienced from poor tooth surface structure due to the "white nitride" layer resulting from an excessive accumulation of iron nitride; this porcelain-like layer is extremely brittle and subject to flaking.

All Nitralloy gears are hardened to a depth of from 0.017 to 0.022 inch in Westinghouse bell type nitriding furnaces. No particular effort is made to keep the furnace load at a certain weight, although should only enough gears be available to constitute a partial load, which falls below a specified minimum, scrap is added to make up the balance.

Each gear is stamped with a load number and furnace number, so that it can be traced back to the furnace should subsequent inspections disclose faults. In addition, three sample washers, which can be checked for case depth and depth of the white nitride layer, are added to each load.

Before turning on the heat, the furnace is purged for a four-hour period with raw ammonia gas. The heat is then turned on, and a five-hour period is allotted to bring the furnace to 975 degrees F. At the end of the five-hour period, the furnace is run for eight hours at 975 degrees F. and at a dissociation rating of from 15 to 30 per cent. Next, to secure better penetration, the temperature is increased to 1050 degrees F., raw ammonia flow is reduced to 5 cubic feet per minute, and 15 cubic feet of dissociated ammonia is added. These conditions—a dissociation rating of 83 to 86 per cent and a temperature of 1050 degrees F.—are maintained for the rest of the run.

Essentially the same cycle is used on all fifty-hour runs, with the result that the case depth is adequate, the hardness is about 92 Rockwell on the 15N scale, and the white nitride layer is held to a maximum depth of 0.0005 inch.

A control card is made for each load. Besides showing furnace operating conditions, it also indicates the number of pieces in the load, the part number, the amount of scrap, the specified case depth, and the case depth actually obtained on the trial washers. This record has been a big factor in improving the quality of the work.

Details of the Carburizing Cycle

Although the majority of large thin gears are nitrided, a considerable number of gears are casehardened by carburizing. The gears are carefully inspected for accuracy before being placed in the carburizing furnaces, and are also checked to insure that the dimensions of those units that are to be die-quenched meet the established die dimensions.

The gears are loaded on fixtures, which helps to minimize distortion, and lowered into Leeds & Northrup carburizing furnaces. These furnaces are previously pressure checked and brought to a temperature of 1700 degrees F. On loading, the temperature usually drops to 1300 degrees F., and approximately one hour is required to bring it back to heat; during this time, a fluid flow of 3/4 pint per hour is maintained for purging purposes. When the operating temperature is reached, the fluid flow is reduced to 1/2 pint per hour. After 4 1/2 hours at heat, gears made of AMS 6260 steel are carburized to a depth of

Fig. 7. Tooth Profiles Recorded by an Involute Checking Machine are Compared with the Master Profile, which is Drawn on a Piece of Lucite. An Aluminum Adapter, which Can be Easily Handled by One Operator, is Used to Mount the Gear on the Machine

0.036 to 0.040 inch—somewhat more than is required, to allow for stock removal.

At the start of the cycle, three test washers of the same material as the gears being carburized are inserted in the exhaust stack of the furnace. One washer is withdrawn one-half hour before the end of the cycle, fractured, and checked by the inspection department for case depth and hardness. If both the case depth and hardness are satisfactory, the heat is turned off and the dampers from the cooling system are opened. The furnace and load then are cooled to 1200 degrees F., at which point the flow of fluid is stopped; they are then further cooled to 1000 degrees F. to prevent oxidation or decarburization of the carburized parts. Finally the load is discharged into the cooling pit.

After cooling, the parts are sand-blasted to remove the carbon soot resulting from the carburizing gas, and the copper-plate that was applied to prevent carburizing of the core areas is removed in a sodium cyanide stripping solution. The gears then are run through a cleaning cycle, and are copper-flashed all over to a minimum of 0.0003 inch thickness for protection against decarburization during subsequent hardening and quenching.

Hardening is accomplished in a continuous chain-belt electric furnace at 1475 to 1500 degrees F. The time cycle is sixty minutes. Upon the completion of the hardening operation, the gears are die-quenched in oil.

Solid plug dies, Fig. 6, are used extensively in quenching, since they permit less distortion than compounding dies. Not much difficulty is experienced with the part "freezing" in the dies, although on rare occasions it is necessary to remove the plug in an arbor press. If such a condition becomes general, chromium-plating can be used to advantage on the locating surfaces of the die. Finally the gears are washed, stripped of copper-plating, and drawn at 250 degrees F. for a minimum of four hours.

Lapping and Inspection Procedure

Following the hardening cycle, the remaining operations performed on the gears are finish-grinding of locating dimensions, lapping, washing, and final inspection. Lapping is performed on a Fellows Hydro gear lapper. The stationary reduction gear is lapped for one-half hour on the driving side and for about fifteen minutes on the non-driving side, after which it is given a complete inspection.

Gears are inspected for flaws not visible to the naked eye by the Magnaflux process, and checked for concentricity, backlash, tooth spacing, tooth taper, tooth profile, and conformity to all dimensional specifications. The tooth profile curves, which are recorded on an involute checking machine, are compared with the profile on the master drawing, as shown in Fig. 7; these master profiles are drawn on sheets of Lucite that can be laid directly over the chart produced by the checking machine. The involute variation on the reduction gear teeth is limited to a rise of 0.0001 inch to 1 degree of the generating angle. Finally, the gears are checked for backlash by the over-wire method.

ONE of the outstanding developments of the Glenn L. Martin Co. in the last two years has been the introduction of a new method of reinforcing aluminum-alloy sheets with a series of formed ridges crossing each other at right angles. The waffle-bead sheet which results is spot-welded or riveted to structures requiring reinforcement, such as ammunition boxes, engine cowlings, doors and hatches, outer wing surfaces, floor panels, landing-gear and bomb-bay doors, radiant-heating panels, insulator blankets for jet-engine exhaust systems, fuel tanks, and other airplane assemblies.

While the principal advantage of this construction is light weight and high strength, the low manufacturing cost also makes it attractive. For example, an investigation was made to determine the most economical method of making a fuel-tank door such as is used on the Martin "Mauler." A multi-detail door was compared with a waffle-bead type door. The multi-detail door consists of an outer skin reinforced by a number of Z-section stiffeners, clips, and corner plates which are riveted and spot-welded together to form a rigid integral door assembly. The waffle-bead reinforced door consists of a single stamped sheet, spot-welded to an outer skin or sheet.

The investigation was based on the production of a sufficient number of doors for 100 airplanes, in lots of fifty. The cost for the multi-detail door was $21.96, and for the waffle-bead type door $8.78. The 60 per cent saving for the waffle-bead door was due to the fact that fewer parts were required in constructing it, resulting in a reduction in tooling and labor cost.

The sketch Fig. 1 shows a Masonite die such as is used for forming ridges on a waffle-bead sheet under a hydraulic press. Cross-section *A–A* taken along the bottom of a groove, shows a sine-wave form, high at intersecting points and lower between the bead crests. The sketch below section *A–A* shows how the waffle-bead is formed along cross-section *B–B* on the die. At this cross-section the elongation in the metal being formed is about 9 per cent. To simplify tooling and production, several waffle beads have been standardized with heights *H* as follows: 0.231, 0.289, 0.347, 0.405, 0.462, 0.696, 0.924, 1.155, and 1.386 inches.

Aluminum Sheets into High-Strength Structures

Sheet-Metal Structures, Formed into a Waffle-Bead Pattern by Drop-Hammers or Hydraulic Presses, are Being Used for Such Airplane Parts as Engine Cowlings, Floor Panels, Outer Wing Sections, and Door Panels

By BERNHARD ROGGE, Design Engineer
The Glenn L. Martin Co., Baltimore, Md.

Almost any aluminum alloy can be used, such as 24S-O, R-301-O, 75S-O, 61S-O, and 14S-O aluminum alloys; however, heat-treatable alloys must be heat-treated either before or after forming in order to obtain the full strength of the material. Magnesium alloys that are hot-formed in the SO condition and corrosion-resisting steel sheets that are formed in the annealed condition can also be used.

An accurate method of tooling has been devised to produce a waffle-bead sheet of a uniform pattern and strength on pneumatic drop-hammers. The first step in producing a uniformly beaded die for such service is to make a master form, as shown at *A*, Fig. 2, of a standard bead intersection, which is machined to conform to the specified dimensions within close tolerances. From this master form, a permanent mold is made, and from this mold numerous pieces are then cast in printer's type-metal. These castings, duplicates of the master bead intersection, are arranged in a uniform pattern on a flat surface plate and locked together in a steel frame, as shown at *B*.

The resulting waffle-bead pattern is then used for making another mold of plaster or gun metal; permanent molds of gun metal are more serviceable and give greater accuracy of detail. This mold is used to cast flexible rubber or plastic blankets, which serve as the master pattern and can be stored for future use.

When a compound-shaped structure is required, that is, a structure that may require curved or irregular contours on the waffle-bead sheet, a base of the same form as the shape of the part to be produced is prepared from plaster or wood. On this base is placed one of the rubber forms of the desired waffle-bead pattern, and plaster-of-paris is smoothed over the top. After the plaster has hardened, the mold is removed from the rubber blanket. The beads are indentations on this reverse mold, and so a positive plaster cast must be made from it, as shown in Fig. 3.

These premolded pieces are fitted together on the master base for use as a pattern in casting the die. Boundary beads are modified, where required, and places left open for the attachment of locks, hinges, and other component parts. Using this pattern, the foundry then pours a Kirksite die. Any irregularities caused by the casting process are ground off, and the entire surface is sanded down with a portable electric disk grinder.

To produce the punch, which is made of lead, the Kirksite die is boxed in with steel plates on all four sides. Into the box thus formed is poured the molten lead from a ladle, supported by an overhead crane, which carries the molten metal from a stationary gas-fired melting furnace to the job on the casting floor. Right after the lead is poured, a series of bolts, arranged in a pattern

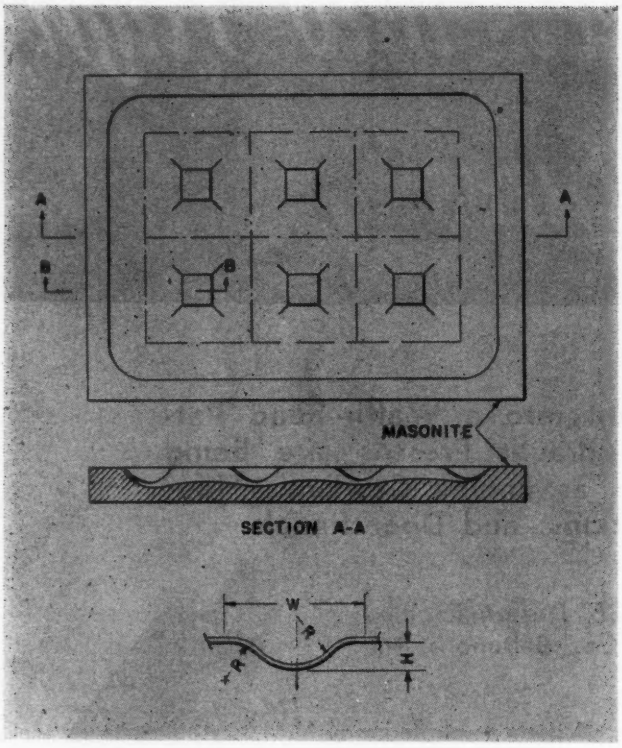


Fig. 1. Sketch of a Masonite Die Used in Forming Ridges on a Waffle-bead Sheet under a Hydraulic Press

that matches the upper head of the drop-hammer, are inserted in the molten metal. The finished punch and die are now set up together.

The heading illustration shows an operator in the act of placing a sheet of 0.032-inch 24S-O aluminum alloy on the die of a drop-hammer. The maximum size of the part that can be stamped is 40 by 88 inches. The sheet is struck with a light blow which draws the metal to about one-half the depth of the die. To prevent the metal from flowing too readily into the die and to forestall wrinkling of the material, a number of 1/4-inch plywood rings are laid on top of the metal sheet, as shown in Fig. 4. These rings perform the same function as that of a draw hold-down ring on a deep-draw die. In this particular case, two rings are used.

After striking a blow with the punch, one of the rings is removed; another blow is then struck and the second ring removed, after which the sheet is given one more blow to draw the metal to about 95 per cent of full depth.

The formed part is then heat-treated in a salt bath at 920 degrees for twenty minutes, after which it is quenched in cold water. Resulting distortion of the part is removed by restriking it in the hammer and drawing the metal to the full depth of the die depressions. The completed sheet is shown in the die in Fig. 5.

The part is then removed from the die and trimmed to size on a high-speed band saw. Burrs left from the sawing operation are removed by the use of a belt sander, after which the part is inspected and sent to the stock-room.

In many cases, it is desirable to use a hydraulic press instead of a drop-hammer to form waffle-bead sheets. To produce tools for this type of press, the printer's type-metal pieces mentioned previously are set up in the desired waffle-bead pattern. Boundary beads, which are also cast from a mold, are cut to the right length and then assembled in a locking frame. The assembled waffle bead can be used directly as the form-

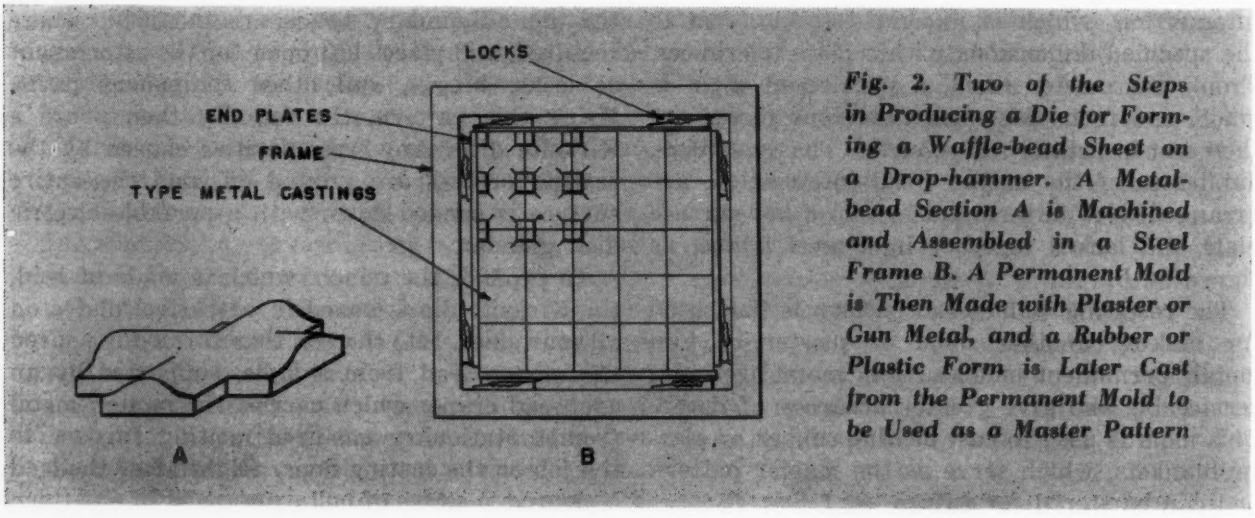


Fig. 2. Two of the Steps in Producing a Die for Forming a Waffle-bead Sheet on a Drop-hammer. A Metal-bead Section A is Machined and Assembled in a Steel Frame B. A Permanent Mold is Then Made with Plaster or Gun Metal, and a Rubber or Plastic Form is Later Cast from the Permanent Mold to be Used as a Master Pattern

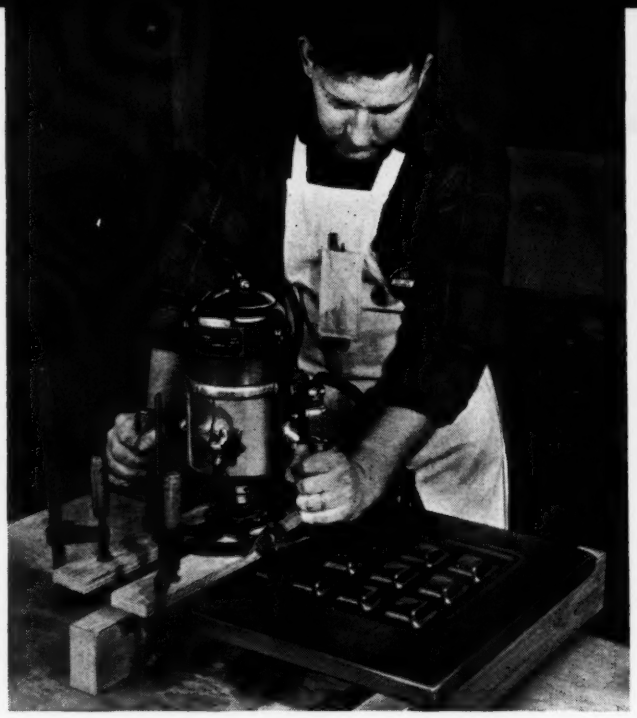
block for producing the metal waffle-bead sheet. This method is especially advantageous on experimental jobs, where the cost of tooling must be kept to a minimum. For more permanent tools, a high-strength plaster or plastic may be cast from the waffle-bead mold. These resulting form blocks are uniform in shape and size, and are economical to make.

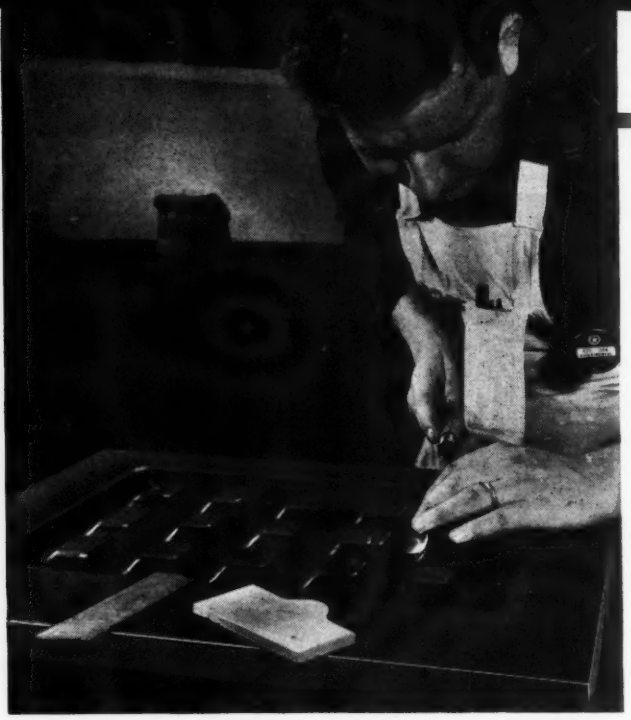
Still another method of producing the form blocks is to lay out the lines or pattern of the waffle bead on a 1 1/2-inch Masonite block with a scriber. The design can be cut by an end-mill of suitable shape in a vertical milling machine or by a portable electric router as shown in Fig. 6. In the vertical milling machine, the Masonite block is clamped to the table and passed under the rotating end-mill, thus cutting the desired grooves into the form block. After

Fig. 3. (Above Left) First a Reverse and then a Positive Plaster Mold are Made from the Rubber Forms. The Final Plaster Form is Used as a Pattern for Casting the Kirksite Die

Fig. 4. (Above Right) Plywood Rings are Used on Kirksite Dies to Prevent Wrinkling during the Drawing Operation

Fig. 5. (Right) After being Partially Drawn on a Drop-hammer, the Sheet is Heat-treated and then Finish-drawn





the grooves have been cut in one direction, the block is indexed 90 degrees for cutting grooves at right angles to those previously cut. This milling operation leaves sharp edges at the intersections which have to be removed by hand scraping; in addition, the intersections have to be deepened, as shown in Fig. 7, to obtain a sine-wave form. The accuracy of the grooves is checked by the patternmaker with the cross-sectional templets seen in the foreground of the illustration, and the finished form block is stamped with a tool and part number for identification.

The maximum size of sheets that have been formed on hydraulic presses is 46 by 62 and 30 by 102 inches. The sheets are located on the form block by two 3/16-inch diameter locating pins on opposite corners. It is necessary to solution heat-treat and quench the aluminum sheets in cold water just before forming begins.

On some jobs a lubricant is required during the forming operation. The selection and application of the lubricant depend on the difficulty of forming encountered; however, it has been found that glycerine is more effective and less troublesome to apply than other lubricants. Also, glycerine is readily soluble in cold water and can be removed without trouble. When lubricants are not used, the depth of the bead that can be formed is limited; this is due to the fact that the rubber punch of the press locks and holds the metal tight on both sides of the grooves, preventing flow of metal from the outer edges into the cavities of the form block.

Fig. 6. (Above Left) Rough-machining the Grooves in a Masonite Form Block with a Portable Electric Router

Fig. 7. (Above Right) After being Rough-machined, Masonite Form Blocks are Finished with Hand Tools. Templets Seen in Foreground are Employed for Gaging Contour of Grooves

Fig. 8. (Left) To Prevent Stress Concentrations, a 1/2-inch Thick Rubber Pad is Laid over Top of Metal Sheet before Drawing Operations

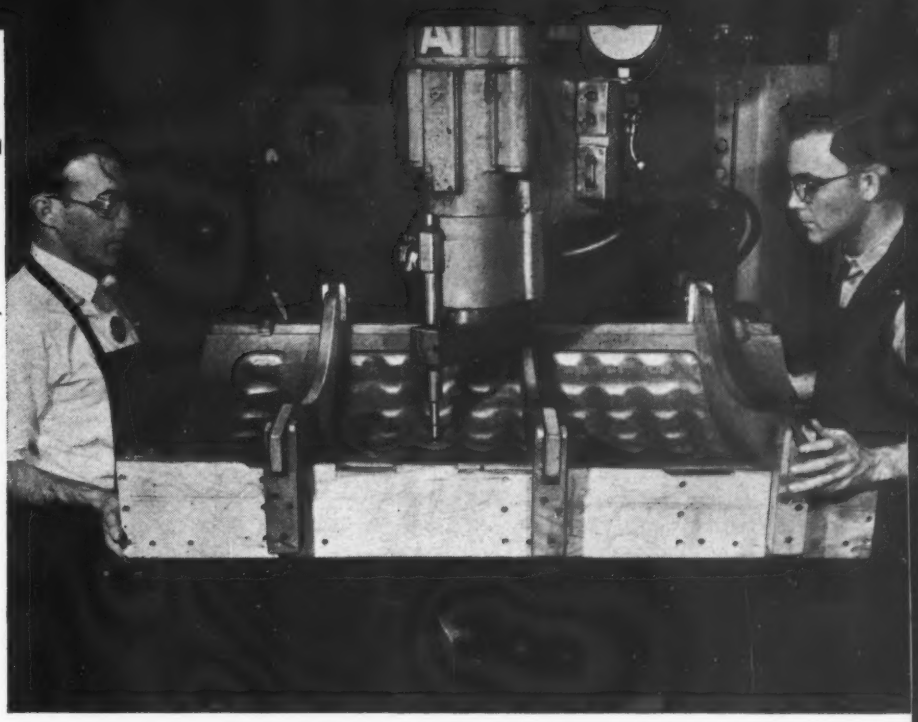


Fig. 9. The Formed Sections are Spot-welded to Plain Aluminum Sheets. A Wooden Fixture is Used to Clamp the Two Parts and Hold Them to the Proper Contour

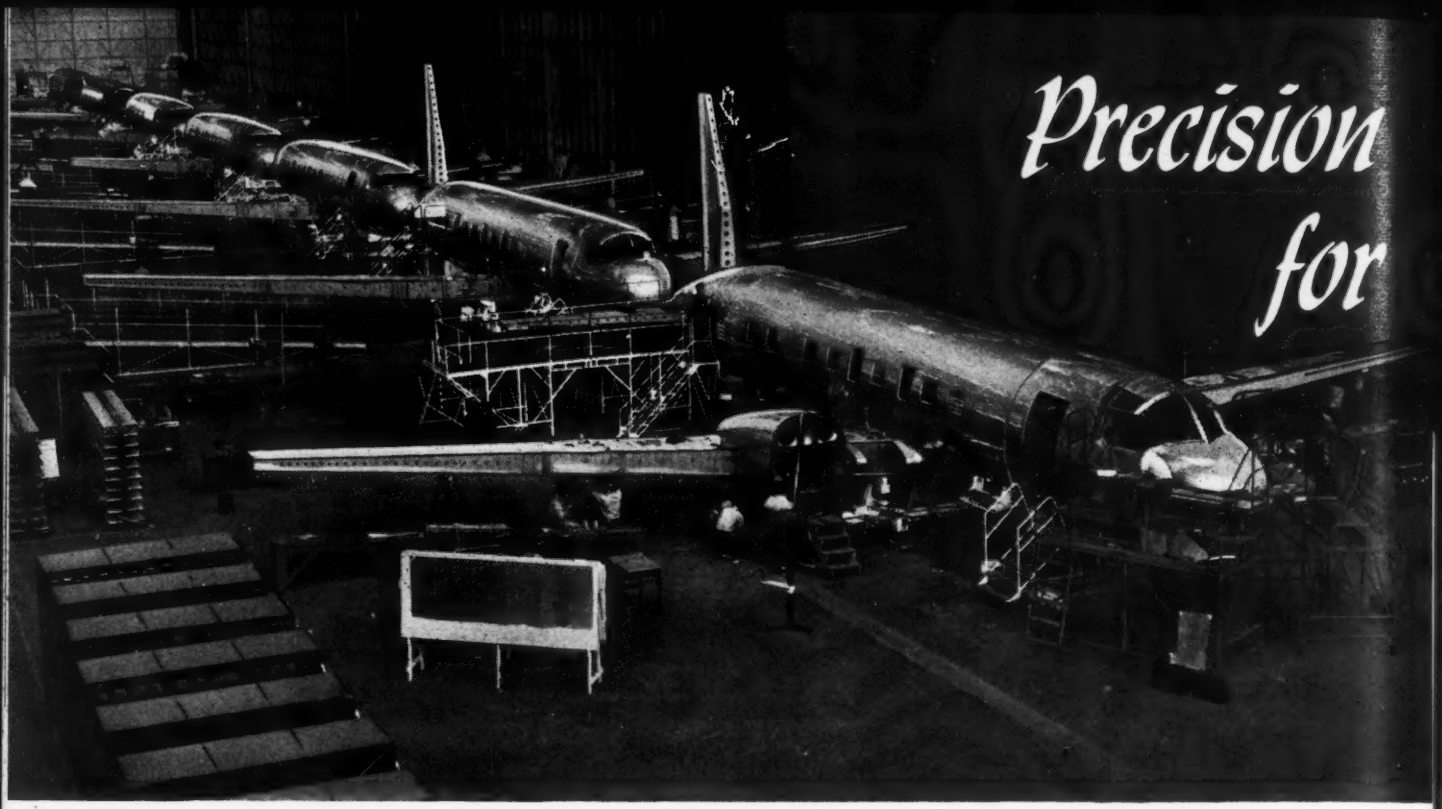
To prevent stress concentration resulting from unevenness of the rubber punch, a 1/2-inch thick rubber blanket is laid on top of the metal sheet as seen in Fig. 8. In forming large panels of 0.16-inch thick aluminum alloy, it has been found advisable to put two sheets together and form them at the same time in order to reduce the number of rejections due to fracture of the metal. The sheets are fed into the press with an automatic loading table and subjected to a pressure of 2200 tons. The formed sheet requires only a trimming operation.

To produce the high-strength structures for bomb doors and other plane parts, an outer skin, which is a plain sheet, is welded to the waffle-bead sheet. This outer skin is sheared to size and, in the case of parts having compound curves, stretch-formed to shape. After the two parts, skin and waffle-bead sheet, are cleaned in an Oakite bath and rinsed with water to remove all grease and dirt, they are assembled in a wooden fixture, which clamps the parts together and holds the metal to the proper contour for the spot-welding operation. This operation is performed on an alternating-current spot-welder, as illustrated in Fig. 9.

The welded panel is then inspected and sent to the assembly department, where all detail parts are added. The completed part, installed in the airplane, is shown in Fig. 10.

The successful application of this type of structure to aircraft construction by the Glenn L. Martin Co. makes it seem probable that similarly formed sheet metal can be used to advantage in many other fields where light weight, low cost, and high strength are desirable.

Fig. 10. Completed Panel Shown Installed on Bomb-bay Door of a Martin "Mauler." The Light Weight, High Strength, and Low Manufacturing Cost of Such Structures Make Them Especially Valuable for Airplane Assemblies



Precision for

Economical Operation of Air Lines Starts with Airplane Manufacture, as It Requires Ready Interchangeability of All Assemblies and Parts

By G. F. GERHAUSER
Chief Tool Engineer, San Diego Division
Consolidated Vultee Aircraft Corporation

IN planning the tooling for the new Convair-240 twin-engine, air-conditioned and pressurized, forty-passenger transport planes now in production at the San Diego, Calif., plant of the Consolidated Vultee Aircraft Corporation, two objectives were kept in mind by the engineering executives responsible for the manufacturing procedure. First of all, the tooling had to be constructed to insure ready interchangeability of all assemblies and parts, so that any number of planes could be literally taken apart, the various assemblies mixed up, and the planes completely reassembled without a misfit. Second, the tooling had to provide for the production of one of these planes every working day.

Accuracy of the tooling was insured by assembling all fixtures on a master tooling dock, which enables fixture dimensions to be obtained to within 0.002 inch of specifications. This tooling dock is provided with longitudinal, vertical, and transverse straightedges, all of which have reference holes that were precisely located and bored on jig boring machines. Jig members can be located with precision from the reference holes in the master tooling dock and jigs can be duplicated with accuracy when more than one of a type are required.

The fixture seen in Fig. 1, which is used in fabricating the outer wing panel, is an example of precision-built tooling. It is the largest jig of picture-frame type used on the Convair-240, being more than 20 feet in length over all. It is constructed primarily of 10- and 14-inch diameter heavy-wall steel pipe. Locations for aileron hinge points are precisely established on the outer wing panel in this fixture, and attachment points for the wing center section are located by the use of the same master plate as is employed for the wing center section, so as to insure interchangeability.

Incidentally, the fabrication of these new planes was facilitated by breaking down the

Building of Convair-240's Low-Cost Maintenance

planes into eighteen major components, which require three fuselage fixtures, eight wing-assembly fixtures, five tail-surface assembly fixtures, and two fixtures for cowling and nacelle assembly.

A general view of one of the fuselage center- or constant-section fixtures is illustrated in Fig. 2. This fixture is massively constructed with a 20-inch diameter pipe backbone for the base and ribs built of 12-inch diameter pipe, side members of 10-inch pipe, and vertical members of 8-inch pipe. Another feature of the jig is the use of overhead arms made of 3-inch pipe which are closed over the work, as seen in Fig. 2, during the construction of the fuselage constant section, and then opened up, as seen in Fig. 3, to facilitate removal of the assembled work from the fixture for transfer to the final assembly line. The lower ends of the arms swing below the mezzanine floor and thus keep the floor clear for workmen. The arms are counterbalanced for easy movement.

The same type of construction was employed for the nose buck, as will be apparent from Fig. 4, and for the tail buck as shown in Fig. 5. The nose and tail bucks and the constant-section fixture are self-contained, and can therefore be moved from one location to another in the shop without affecting any of their locators. Masters used in setting up these fixtures insure interchangeability of the components fabricated in them.

The center section of the wing is composed primarily of front and rear spars, bulkheads, and skin stringer panels. These components are assembled in a vertical fixture of the type illustrated in Fig. 6, which is constructed on a base consisting of the 20-inch heavy-wall pipe shown in Fig. 7. The vertical column seen in Fig. 6 is also built from a 20-inch steel pipe. The pipe base extends from a center steel box to steel boxes that are outboard of the splice. The splice location is controlled by means of a large steel casting having bushed holes that are used in bolting the spar splice fittings and splice angles to the splice plate. Horizontal movement of the casting is accomplished by means of a lead-screw, the casting being moved on ways so as to provide the proper chord-line relationship.

Attached to the wing fixture seen in Fig. 8 is

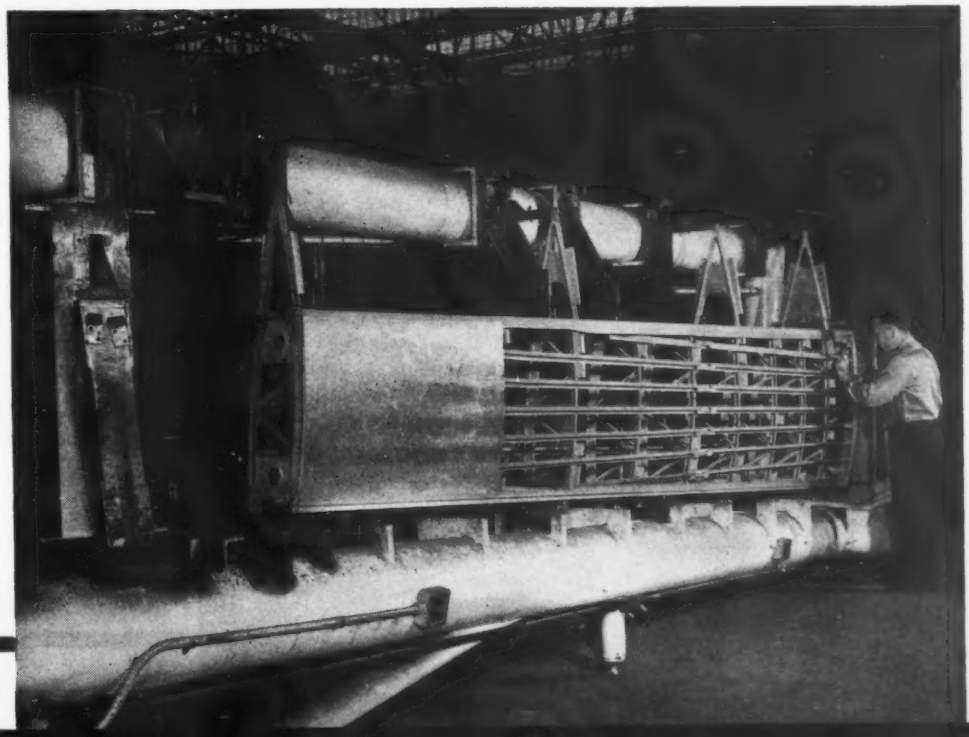


Fig. 1. The Largest of a Number of Picture-frame Fixtures Used in Building the Convair-240's. The Main Members of This Fixture for Outer Wing Panels are 10- and 14-inch Heavy-wall Steel Pipe

Fig. 2. One of Four Fixtures for the Fuselage Constant Section. The Overhead Arms Can be Swung Open to Facilitate Removal of the Completely Fabricated Section from the Fixture

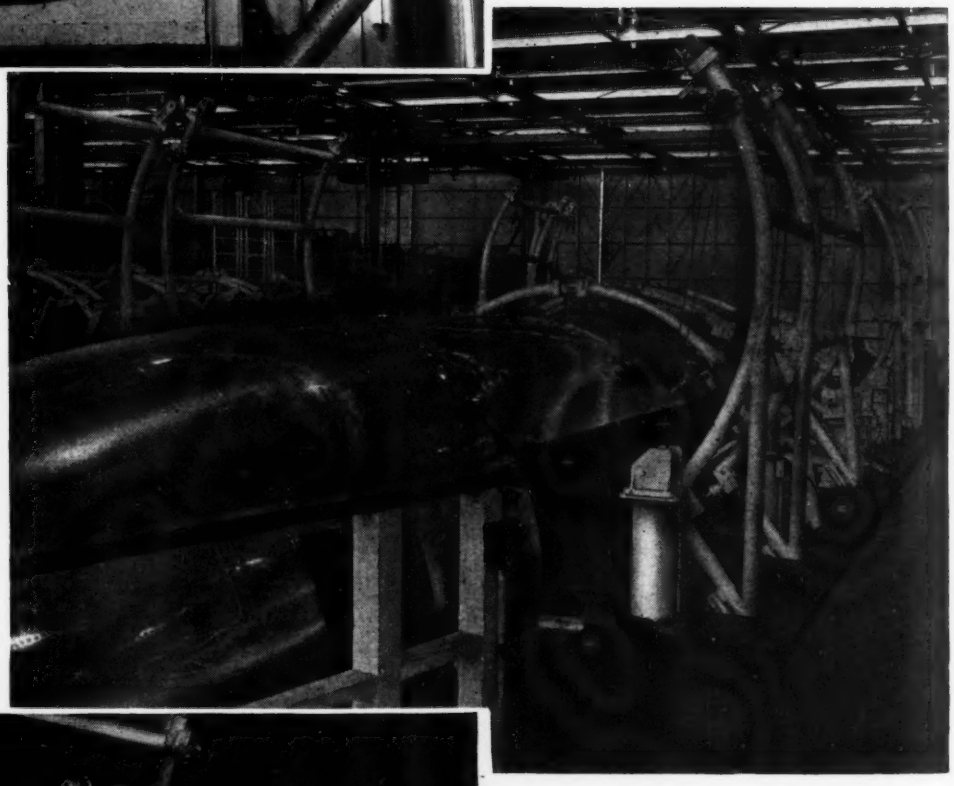


Fig. 3. Another View of a Constant-section Fixture which Shows Several of the Overhead Arms Retracted and Others in the Position that They Occupy while the Work is being Fabricated

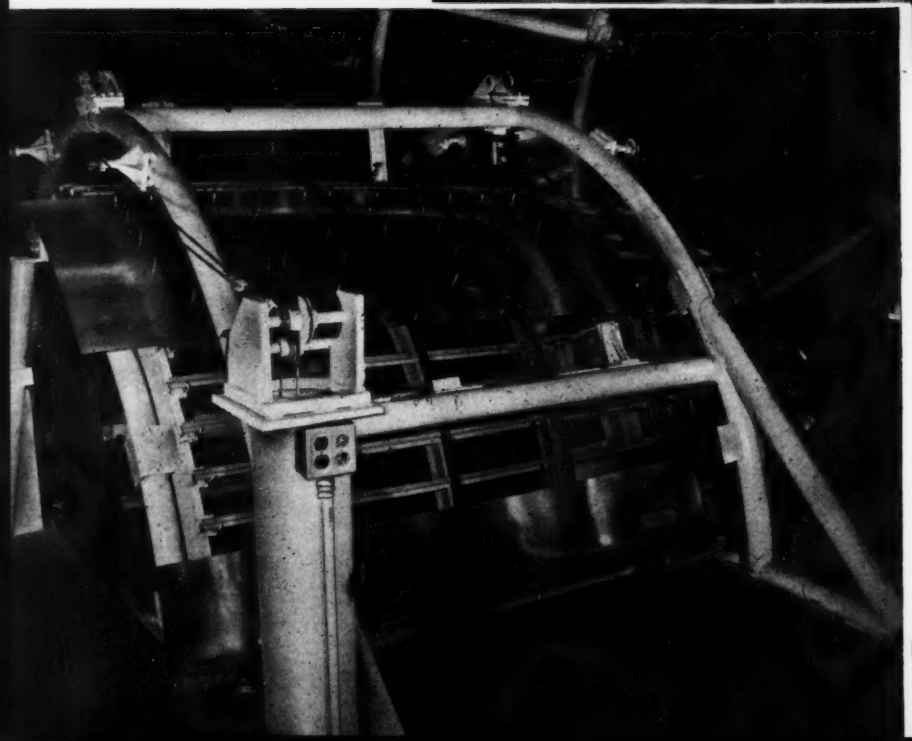


Fig. 4. Nose Sections are Assembled in Fixtures of the Type Here Illustrated. These Fixtures are also Provided with Retracting Overhead Arms for Convenient Removal of the Finished Job

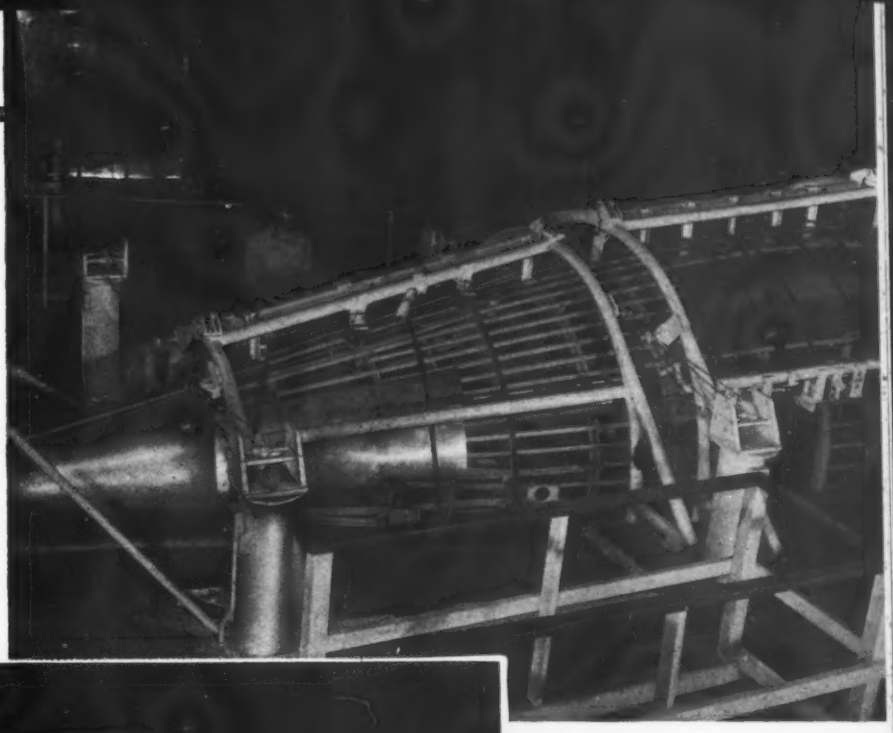


Fig. 5. The Fixtures Used for the Conical Fuselage Tail Sections are of the Same General Design as Those Employed in Fabricating the Constant-center and Nose Sections, Shown in Figs. 2 and 4

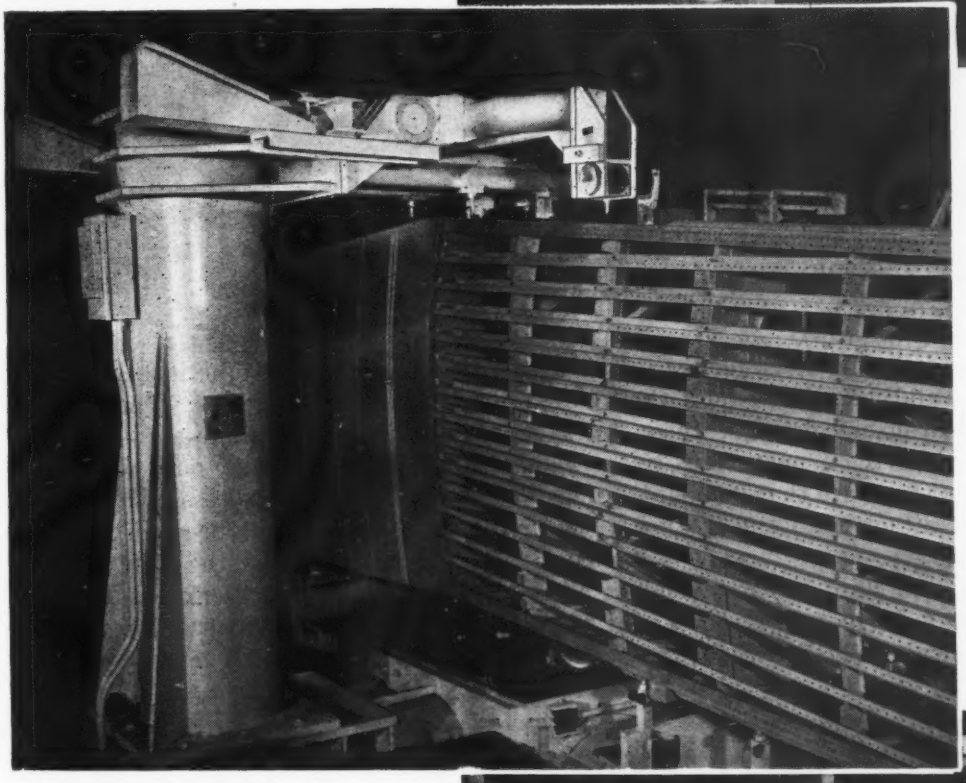


Fig. 6. Partial View of a Wing Fixture, Showing Sturdy Construction of Vertical Steel Column. This Fixture Provides Unusual Accessibility for Wing Assembly

Fig. 7. The Backbone of the Fixture for the Wing Section Consists of a 20-inch Heavy-wall Steel Pipe. Another Feature of This Fixture is the Provision for Clamping the Spar against Locating Pins

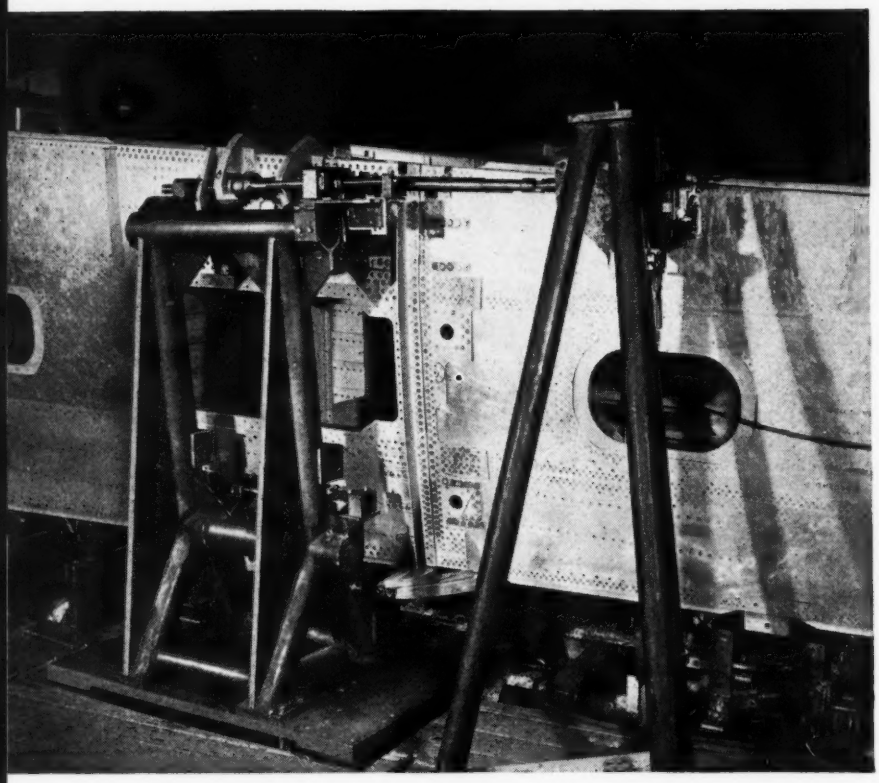


Fig. 8. The Fixture for the Wing Center Section is Provided with a Sturdy Steel Structure to which a Pneumatic Drill is Attached for Boring, Reaming, Spot-facing, and Back Spot-facing Operations

a removable pneumatic drill that is employed to bore, ream, spot-face, and back spot-face the main landing-gear and drag-link fittings. Interchangeability is insured in these operations by supporting the drill on a structure that is mounted on machined plates attached to the 20-inch diameter base pipe.

Fuselage belt frames and skin stringer panels are generally assembled and riveted on indexing fixtures of the type shown in Fig. 9, which were designed for use in conjunction with Erco punching and riveting machines. These fixtures are fabricated from aluminum-alloy sheets on which engineering master lay-outs were reproduced by a photographic process. This practice has eliminated virtually all production rework time. The operator swings the fixture around the machine anvil after the work has been properly positioned around the fixture. The particular fixture shown is about 10 1/2 feet in diameter.

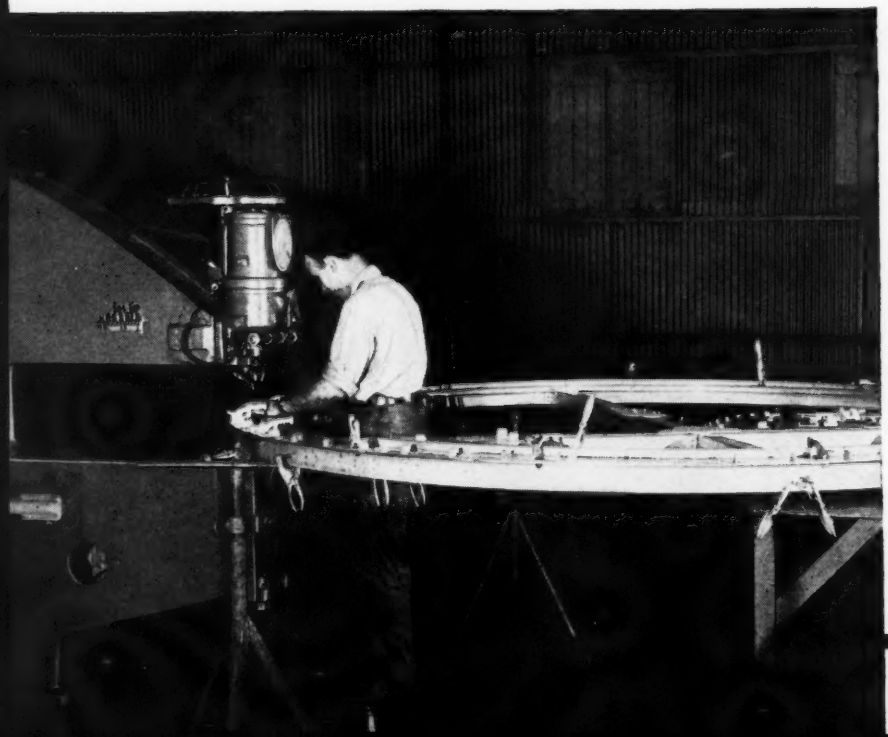


Fig. 9. Indexing Fixtures of the Type Here Shown are Used in Conjunction with Erco Punching and Riveting Machines in the Assembly of Belt Frames, Bulkheads, and Skin Stringers

Aircraft Production Present and Future

THE problems of aircraft designers did not end with the conclusion of hostilities. Today, the efforts of aeronautical engineers are still directed toward the development of jet-propelled bombers, flying missiles, rocket ships to exceed supersonic speeds, and transports for carrying hundreds of military men. Designers are also engaged in the development of faster and more comfortable commercial transports in an effort to maintain the prestige of American aircraft builders the world over.

Production engineers in the aircraft industry are engaged in developing manufacturing methods that will enable the ideas of the plane designers to become actualities. For example, when new alloys of increased strength become available, as in the case of 75S aluminum alloy, it becomes the job of production men to develop means of fabricating the material economically. The need for open minds in considering new manufacturing methods is just as great as in the days when aircraft production men adopted such revolutionary manufacturing processes as negative-rake milling and deep-drawing of magnesium.

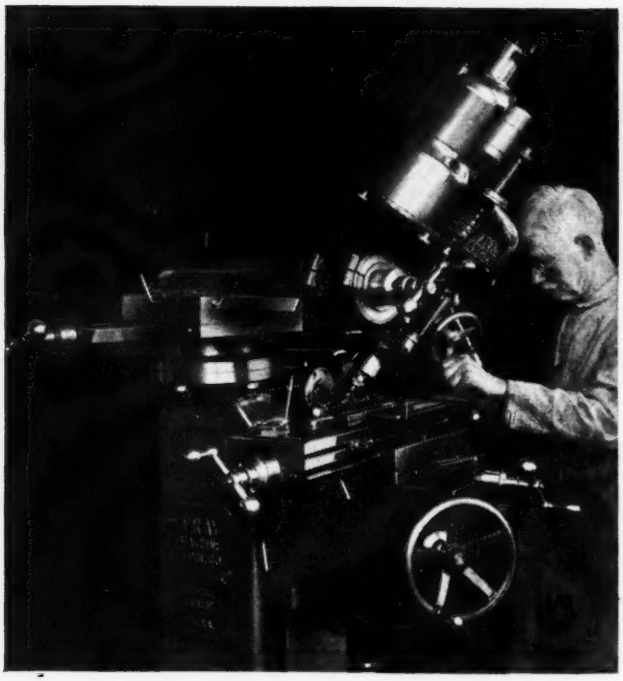
Aircraft production engineers were notably progressive during the war years. That they are continuing to operate with remarkable foresight is indicated by the articles in the special editorial section of this issue of MACHINERY—the ninth Aircraft Production number.

Aircraft building is still a big industry —while not of the fantastic proportions attained during the war, when almost 100,000 planes were produced in a single year and the total employment was over 2,000,000, yet large enough to be ranked among the important industries. Total employment today in aircraft building plants is between 185,000 and 200,000 persons. The dollar value of the 1947 output should amount to approximately $700,000,000, according to estimates. These post-war figures compare favorably with aircraft building statistics of 1939, when planes were already being built for warring countries. Employment reached around 49,000 persons in that year, and the production had a value of about $280,000,000.

The industry would be operating today at a much higher production level were it not for the fact that the sale of surplus aircraft has pre-empted both domestic and export markets for some time to come. So far, the Government has sold about 26,000 planes from surplus—2000 transports of two- and four-engine types, in addition to 24,000 liaison and personal planes. When it is recalled that all the air lines of the United States operated only 350 transports in 1939 and the rest of the world had fewer than 2000 planes of all types in scheduled service, it can be easily understood what surplus aircraft sales did to a potential commercial market.

When current plane models grow obsolete, five to ten years from now, and surplus planes wear out, peacetime airplane production should reach heights far above what they are today. Military aircraft development and production must also continue at a high rate in order to keep up with similar activities of less peace-minded nations. The future augurs big things for the aircraft industry.

Charles O. Herb



Using a Fray "All Angle" Attachment on a Rush Jig-making Job

Rush Order for Jigs Filled in Record Time by Use of "All Angle" Attachment

Nineteen jigs for use in cutting knife blades were recently produced in record time at the plant of the Federal Tool Co., Johnston, R. I., on a Fray milling machine equipped with an "All Angle" attachment. In two hours, the nineteen jigs were machined and on their way to the knife company, with a saving in time of more than seven hours over any methods previously employed for such work.

Since the head, turret, and table movements on the Fray milling machine can be accurately controlled, being provided with easy-to-read calibrations for every adjustment, the work did not have to be reset after once being clamped to the table. The Fray "All Angle" head, as well as the turret itself, was rotated instead of moving the work for the various operations.

* * *

Motion Picture on Man-Au-Trol Lathe

The Bullard Co., Bridgeport 2, Conn., announces that it now has available for showing to authorized groups a 16-millimeter sound film on the Man-Au-Trol vertical turret lathe. The running time of the film is twenty-seven minutes. Another 16-millimeter sound picture, which runs for fourteen minutes, shows the operation of the Man-Au-Trol spacer. Further information can be obtained from the company.

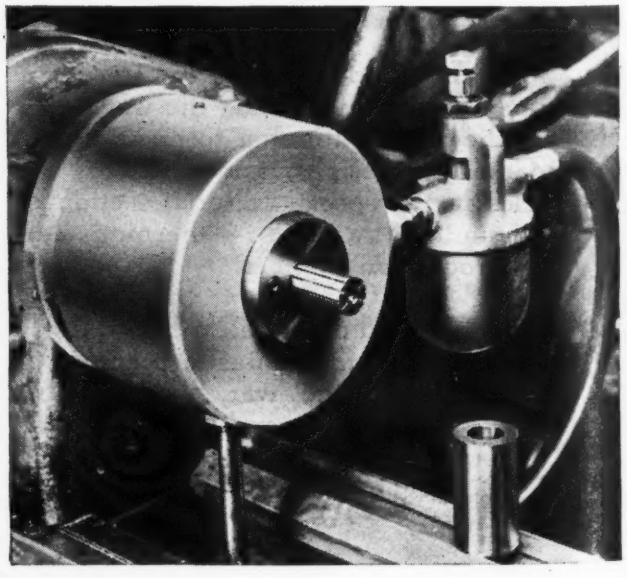
Semi-Annual Meeting of A.S.M.E.

The semi-annual meeting of the American Society of Mechanical Engineers will be held in Chicago from June 15 to 19, inclusive, with headquarters at the Stevens Hotel. The theme of the meeting will be "The Engineer's Responsibility in Increasing National Productivity," and the program will include forty technical sessions devoted to metals engineering, production engineering, materials handling, machine design, fuels and power, and related subjects. Several sessions will be devoted to gas-turbine power plants, and one session to the problems attendant to atomic power development. Charles E. Wilson, president of General Motors Corporation, will speak at the opening dinner, and Robert R. Wason, chairman of the board of the N.A.M., and president of Manning, Maxwell & Moore, Inc., will be heard at the banquet.

* * *

Air-Operated Mandrel Solves Difficult Work-Holding Problem

By employing an air-operated mandrel, as shown in the illustration, to hold a lock barrel while turning and facing, a production rate of over 4000 pieces per eight-hour day was obtained. Foot-pedal control of the mandrel had the advantage of leaving both hands free and reducing operator fatigue. The Erickson air-operated mandrel which solved this problem permitted the work to be held securely at the extreme front end of the sleeve only, and at the same time, assured accurate alignment.



Lathe Equipped with Air-operated Mandrel for Handling Difficult Turning and Facing Jobs

Electric Arc-Welding Results in Improved Press Design

Electric arc-welders made by the Lincoln Electric Co., Cleveland, Ohio, are playing an important part in the mass production of the line of hydraulic universal presses built by Rodgers Hydraulic, Inc., Minneapolis, Minn. These presses, though developing up to 200 tons pressure, are light in weight and portable. They are made in eight models with pressure capacities ranging from 50 to 200 tons, and are applicable to a wide range of operations, including gear and sprocket pulling, removing sleeves and bearings, erecting machinery, relocating machinery, straightening shafts, pressing on wheels, and general press work.

Electric arc-welding has made it possible to design and fabricate rigid members and bases of improved appearance, as well as to reduce the over-all weight and fabricating costs of these presses. Joint preparation for the welding operations consists of machining deep grooves in the cylinders, gas-flame cutting the butt and lap joints on the framework, and gas-flame cutting the heavy parts. Single passes, using "Fleetweld 7" and "Fleetweld 37" 5/32- and 3/16-inch electrodes, were made on all frame-fabrication operations, while two passes, using the same type and size electrodes, were used on press slide parts such as shown in Fig. 3. A "Fleetweld 9" 1/4-inch electrode was used for welding operations on cylinder heads like the one shown in Fig. 2, four passes being required to complete this part.

This is one of many examples of improvements in design made possible by welding.

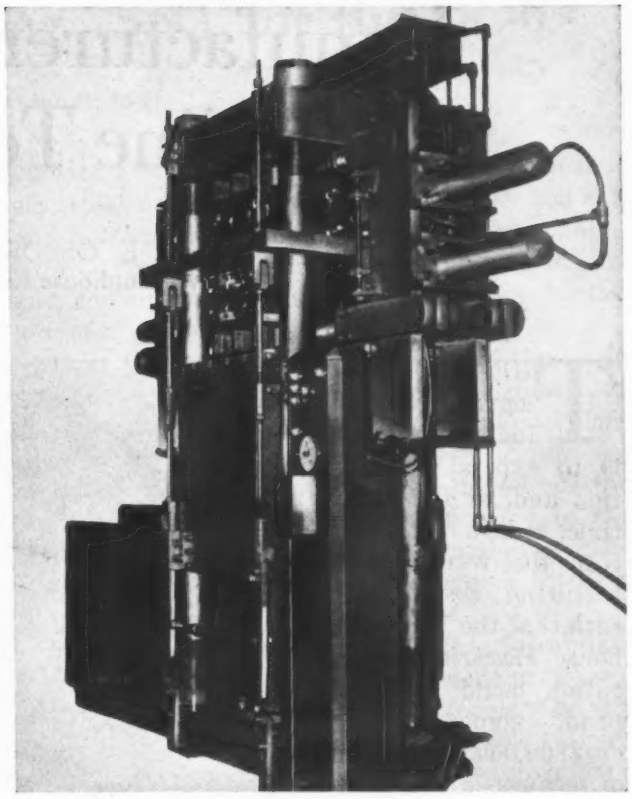


Fig. 1. Molding Press Fabricated Largely by Arc-welding and Flame-cutting Operations

Digest of Articles on Plastics

The British Plastics Federation, 47-48 Piccadilly, London, W.1, England, is publishing each month a pamphlet containing abstracts of articles dealing with plastics that have appeared in journals all over the world, as well as in British patent publications. These pamphlets are obtainable for 5/6d a copy or 1£ 3/ per year.

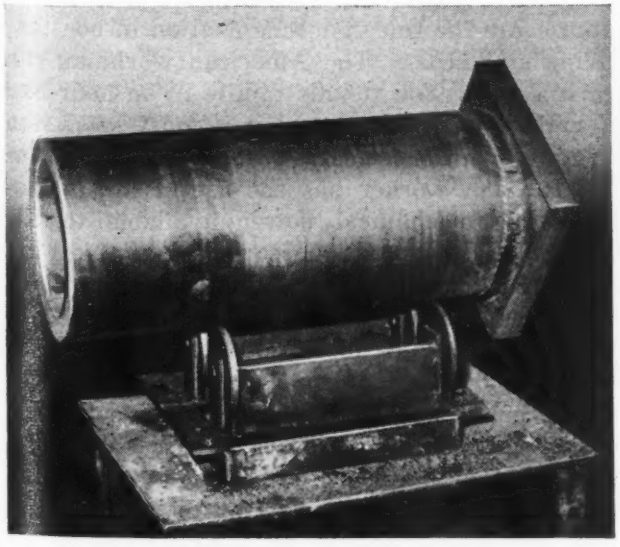


Fig. 2. Small Hydraulic Press Cylinder Mounted on Fixture Used in Welding Operation

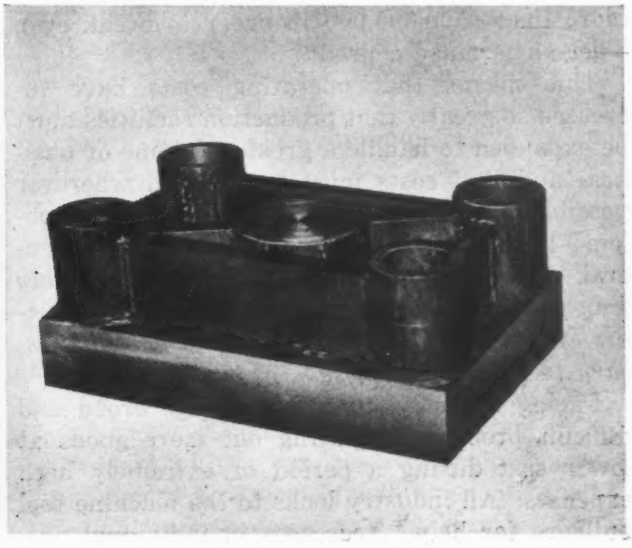


Fig. 3. Complicated Press Slide Constructed of Arc-welded Seamless Tubing and Steel Plates

Manufacturers Look to the Machine Tool Industry

By L. E. OSBORNE, Vice-President
Westinghouse Electric Corporation

THE chief problem confronting industry today is to expand production and, at the same time, reduce costs. Before the war, manufacturing costs were such that the Westinghouse Electric Corporation could make a profit—a good profit—on $200,000,000 worth of business a year. In fact, there were only three years in the history of the company prior to the war when the business reached that value. Today, however, operating costs are so high that a tremendous amount of money is lost on an annual business of $200,000,000. As a matter of fact, it was learned during 1946 that the company must have a business of substantially more than $500,000,000 in order to break even—let alone make a profit.

This means that operating costs have increased so greatly that production facilities must be expanded to handle a greater volume of business and that costs must be reduced wherever possible. This is not only Westinghouse's problem—it is a problem faced by industry in general. *More production at lower cost is the only way for a company to reduce prices to consumers and at the same time allow the profit necessary to keep in business.*

Facing industry, therefore, is the broad and difficult problem of getting out more goods at lower cost during a period of extremely high expenses. All industry looks to the machine tool builders for help. Increases in individual productivity cannot be depended upon to solve the problem—most executives have experienced a rise in the cost of labor without a corresponding increase in production effort. Increased application of mechanical power and power-driven tools and equipment must do the job if output per man-hour is to be increased. It will have to be done with more fully automatic machine tools and with production processes that reduce the human equation to the greatest possible extent.

Fortunately, history has shown that increased mechanization yields greater benefits to everyone concerned—employes, consumers, and owners—in fact, to the entire nation. It is only necessary to compare life in the United States with that in other countries to appreciate the role of mechanization in boosting living standards. The American workman can earn a day's food for his family in an hour and a half—the Russian workman must work ten hours to achieve the same result. This is because the Russian worker has the use of about one-sixth the mechanical power available to the American workman—consequently, he takes six times as long to produce an equal product.

Industry is being called upon to do the "impossible"—produce more goods at lower prices while shouldering higher operating costs. Once again, industry looks to the machine tool builders to help it produce more at less cost. The coming Machine Tool Show, with its extensive exhibits of the very latest types of high-production equipment, should be a great aid to all manufacturing executives confronted with industry's greatest present problem.

Hot Dimpling and Joggling 75S-T for the DC-6's

(Continued from page 150)

the material is gripped during pre-pressure makes it impossible to obtain arc-free resistance heating. One of these machines is shown in operation in Fig. 5; a close-up view of the tooling is seen in Fig. 2. A pre-pressure of from 6 to 8 pounds per square inch insures satisfactory transfer of heat to the stock by conduction during the controlled dwell period, after which the full pressure is automatically applied to produce the dimple. A pilot on the die is employed to locate each hole for the dimpling operation.

De-icer dimples are produced on the leading edge of wings by applying vibration dimpling machines equipped with heaters as shown in Figs. 6 and 7. These machines were built by Douglas and fitted with a Chicago Pneumatic air gun. Both top and bottom capacitors are maintained at a temperature of 600 to 650 degrees F. to obtain the required sheet temperature in the areas to be dimpled. The hot tools grip the material for about fifteen seconds before the tool starts vibrating to form the comparatively large dimples. The holes are, of course, drilled in the sheets and burred before the sheets reach these machines.

Portable units have also been built for localized heating of 75S-T aluminum alloy in dimple-squeezing operations. Such an operation is illustrated in Fig. 8; the electrical and pneumatic control unit may be seen in the foreground. The heating elements are maintained at a temperature of between 625 and 675 degrees F., and the minimum dwell period is four seconds. The pre-pressure is the highest that can be applied without forming the dimple. Sheets up to 0.064 inch thick can be dimpled with the tool. Operators of the equipment must allow the tools to attain working temperatures before dimpling is started.

Fig. 9 shows an operation in which a heated bell bar is used to back up a vibrating dimpler. A control box similar to that seen in Fig. 8 indicates and controls the tool temperatures and the dwell period. The bell bar is heated to between 625 and 675 degrees F., and the square-block capacitor (also shown in Fig. 8) to from 575 to 600 degrees F. Stock up to 0.128 inch thick can be handled with this equipment. The minimum dwell period is fifteen seconds.

Joggling operations on extruded or rolled angle and hat sections of 75S-T aluminum alloy are performed hot on the Niagara punch press seen in Fig. 10. The die members are heated to about 500 degrees F. Fig. 11 shows a close-up view of a typical operation. It will be seen that electrical cables are connected to both the top and bottom dies, which are used as heat capacitors. The temperature of each die is indicated and controlled by the instruments seen at the left of the press in Fig. 10.

After the operator places one leg of the angle section between two heated sliding members of the bottom die, he operates an air valve to close the sliding members firmly on the angle leg and start an electrical timer. At the end of the heating period, a red light incorporated in the timer equipment flashes on and signals the operator to depress the foot-treadle, which actuates the press and completes the joggle.

For parts that are not ordinarily gripped during the joggling operation, a spanker die is used. In this unit, the upper heated die member descends on the work for a dwell period, after which the pressure is increased to form the joggle bend. During the forming operation, the temperature of light-gage parts rises rapidly to that of the die members, but the time interval is so short that the material is not damaged.

Preliminary attempts to bend joggles without a heated upper die member resulted in cracks on the top leg of the angle. Earlier efforts to form preheated material in cold dies also proved unsatisfactory because the cold dies dissipated the heat too rapidly. Attempts to form 75S-T extruded shapes with the work and dies at room temperature were completely unsatisfactory. Over two hundred and fifty types of heated joggle dies have been made for a wide variety of extruded and rolled sections.

Douglas experience in building DC-6 planes thus far has been that 75S-T aluminum alloy can be punched, dimpled, and joggled as satisfactorily as 24S-T aluminum alloy, or more satisfactorily.

* * *

High production removes the hazard of inflation and brings prices within the reach of the mass market. Wage rates not justified by labor productivity and prices not justified by manufacturers' costs may bring the illusion of prosperity. In the long run, however, good wages, full employment, and sound business profits must depend upon management and workers cooperating to produce the maximum volume of goods at the lowest possible price.—*President Truman*

Engineering News

Atom Smasher that Yields Beam of 70,000,000-Volt X-Rays

A beam of 70,000,000-volt X-rays has been produced in the Research Laboratory of the General Electric Co. from a new and compact type of atom smasher known as the "Synchrotron." The successful application of this device, which was built as part of a project sponsored by the Office of Naval Research, indicates the possibility of producing radiations of much higher energies, for atomic study, with greater economy than was possible with earlier equipment.

At the beginning of each cycle of operation of this equipment, the cycles being repeated sixty times a second, the electrons are injected from a hot filament and are speeded as the magnetic field builds up. When they have acquired energies of about 2,000,000 volts, they are moving at 97 per cent of the speed of light—186,000 miles per second. They cannot go faster than light, so that further increase in energy is manifested as an increase in mass.

Scientists Seek Jet Engine Secrets in Bombproof Dugout

In a bombproof dugout at the Westinghouse Research Laboratories, scientists soon will begin to explode whirling red-hot disks of metal in an effort to determine the maximum strength of parts for aircraft jet engines. Disks of specially developed alloys, 1 foot in diameter and 1 inch thick, will be heated to temperatures above 1400 degrees F. and spun at 1200 miles per hour—35,000 R.P.M.—until they literally fly apart.

The disks will be placed in the center of a specially constructed pit lined with sand bags, and attached to the shaft of a high-speed motor located 10 feet below the floor. Electric heating coils will provide the high temperatures required. During testing, the 32-pound disks will be covered by thin steel hoods, from which the air will be evacuated to reduce friction. The hoods are constructed of 1/8-inch thick steel, so that flying fragments of the metal will easily penetrate them. The use of a heavier steel would cause serious damage to the fragments and prevent close scrutiny of the type of fracture or break involved.

Continuous measurements will be made of the temperature of the disk, and periodical measurements will be made of the expanding diameter of the disk. Under high stress and temperature, all metals tend to creep, and with the very narrow clearances in the gas turbine, a knowledge of this rate of creep is vital.

These destruction tests are aimed at revealing the ultimate strength of alloys now used in gas-turbine rotors for jet-engine application. It is planned to simulate and even exceed actual service conditions until the metal breaks, in the hope of deriving a set of principles from which the behavior of alloys at any temperature and speed can be predicted.

Fathometer Maps Ocean Bottom for Mariners

An instrument, designated the "Fathometer" by the Submarine Signal Co., now permits mariners to stand on the ship's bridge and actually watch the sea bottom's contours changing under them. The Fathometer takes soundings by generating sonic vibrations in a transmitting oscillator, "pitching" them at the sea bottom, and then "catching" their echoes with a receiving oscillator. Ocean depth, in fathoms, appears on a dial indicator that measures elapsed time. The oscillator is composed of a stack of thin nickel plates laced with wire. Current flowing through the wire creates a fluctuating magnetic field which makes the nickel plates contract and expand sharply, sending out a powerful hum. During the war, the Fathometer helped our tanker fleet navigate safely through uncharted waters. Today, this equipment is finding wide peacetime applications.

Metallurgy of Steel Surfaces Changed by Friction

Metallurgical as well as geometrical changes can be brought about in lubricated steel surfaces by friction when two hard steel or cast-iron surfaces slide over each other, according to statements made by Bernhard W. Sakmann, research engineer, Carter Oil Co., Tulsa, Okla., in a paper presented before the American Society of Mechanical Engineers.

In the first group of a series of tests, friction flats of various steels and cast iron were run-in against babbitted or anti-friction alloy surfaces. Only geometrical changes were observed. Then in a second group of tests, hard surfaces of alloy steels and cast iron were run-in against cast iron and alloy steel. Geometrical changes were observed as in the first tests but, in addition, the two tests revealed that when two hard surfaces are run against each other, metallurgical changes take place.

Transformed material was found to be considerably harder than the martensitic steel of the test samples, and the etching characteristics of the transformed metal were markedly different from those of the underlying steel. Initially smooth surfaces took the form of ridge-like eruptions that protruded above the surface of the friction flats to the extent of several microns.

Portable Machine Simulates Service Forces in Structures

To induce vibrations in assemblies and structures and thus simulate forces that are encountered in service, the Baldwin Locomotive Works has designed a portable oscillator weighing only 61 pounds. Tests with this unit indicate such characteristics as the natural frequency of vibration, the flutter, and the fatigue strength of a structure, or the riding qualities of a vehicle.

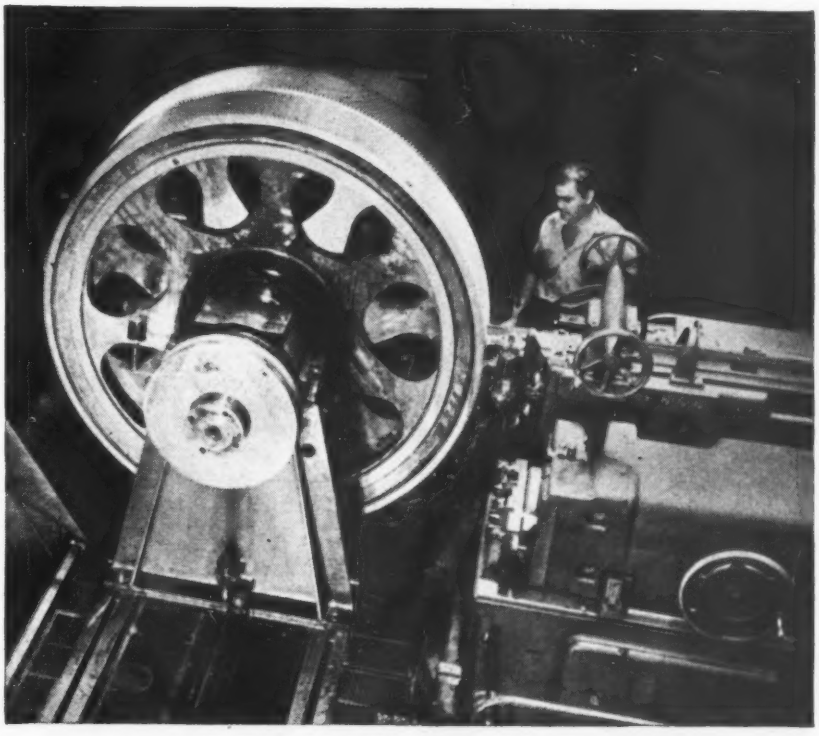
Over eighty per cent of the service failures in machines and structural parts are caused, at least in part, by dynamic forces. Even though the design engineer carries out dynamic testing on material specimens to determine their physical properties, it is apparent that the completed structure should be subjected to similar tests, in order to check its serviceability. No test is as good as an actual service test, but this is usually impractical because it takes too long and is too expensive. Consequently, mechanical oscillators were developed, first for testing railroad bridges and later for testing a wide variety of structures, including aircraft, land vehicles, buildings, and foundations.

Vibrations are produced in the new portable oscillator by eccentrically supported weights, which, when rotated, add all the forces in one direction and cancel all the forces in the other. These forces can be adjusted either while the machine is running or while it is stationary. The maximum force in the machine itself is 1600 pounds, but this is multiplied by resonance in the structure, sometimes as much as 200 times.

Marine Gear Manufacture Speeded by Shaving Teeth

Gear shaving is being applied in the construction of marine gears at Westinghouse as a means of providing a better finish on the teeth. The idea of taking a thin slice from the surfaces of teeth after they have been formed by hobbing has worked well on small gears, but has never before been applied, it is believed, to gears 8 feet in diameter and capable of transmitting several thousand horsepower, such as those used for aircraft carriers.

Gear shaving removes feed marks and other surface imperfections left by the hobbing machines. By this operation, it is possible to obtain full face contact without recourse to lapping or other finishing methods. Furthermore, when a shaving operation is to be employed, hobbing feeds and speeds can be increased as much as 50 per cent without sacrifice of accuracy, the somewhat rougher surface finish produced being corrected by the shaving operation.



Tooth Surfaces of Big Marine Gears are Shaved after Hobbing, thereby Eliminating All Tool Marks

Transfer

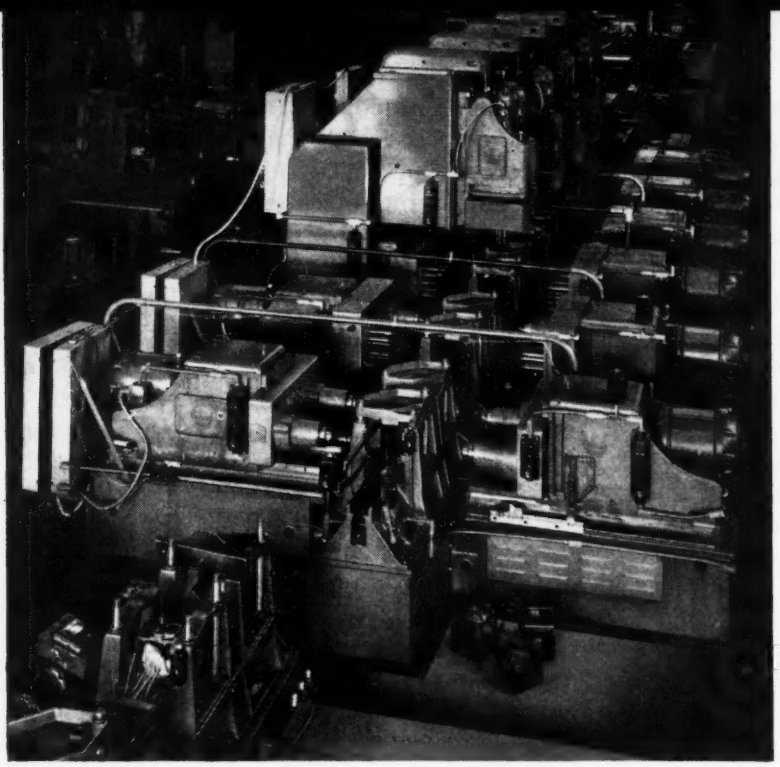
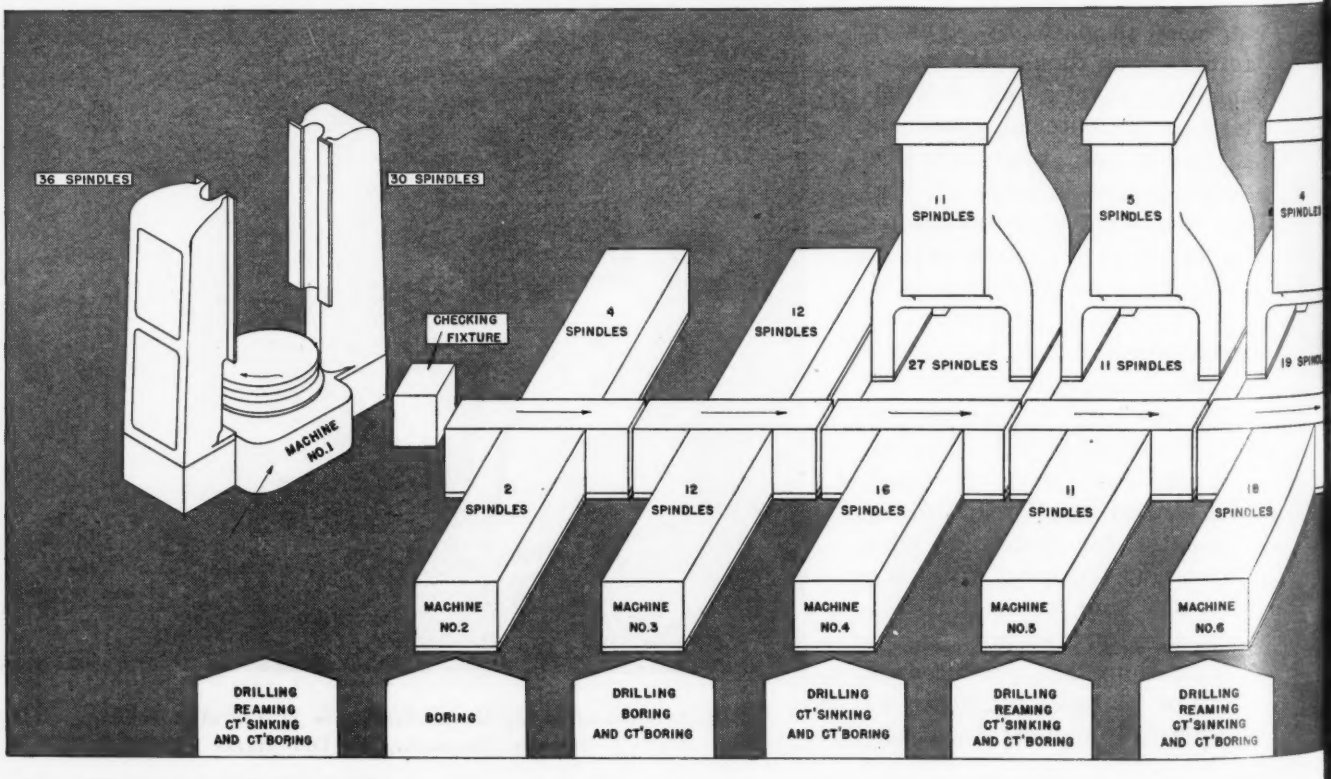


Fig. 1. Seven Units of a Transfer Machine Line Designed for Machining Automotive Transmission Cases. The Arrangement of the Complete Transfer Line is Shown in the Diagram Below

AUTOMATIC transfer machines, used extensively for drilling, boring, spot-facing, reaming, tapping, milling, and other operations on parts produced in large quantities, such as automotive transmission cases, cylinder blocks, and crankcases, are among the most complex types of industrial equipment. Obviously, any design simplifications that can be made without affecting the efficiency of these machines not only decrease maintenance and operating costs, but also widen the scope of their applications.

An important step toward such simplification was recently made by the Baush Machine Tool Co., Springfield, Mass. In the past, each machine in the transfer line was so closely integrated with every other unit that a minor change in the design of the workpiece often necessitated a major change in the entire line. To eliminate this difficulty, the Baush Machine Tool Co., has sectionalized its transfer machine, so that individual units are as independent as in the more conventional production lines. This design has the advantage that individual machines can be rearranged if it is

Fig. 2. Schematic Flow Diagram Showing Travel of the Work through the Transfer Machine. The Actual Transfer Line Starts with Machine No. 2



Machine of Sectional Design

found desirable to change the machining cycle in order to improve the efficiency, and the leveling and lining up of each unit is less critical than in one continuous line; but more important, these improvements have been accomplished with no decrease in output.

The transfer unit can be used with standard type vertical, horizontal, two-way, and three-way machines. The progressive system has been applied to the hydraulic transfer cycle, with the result that each unit in the line must complete its cycle before the next function can be applied by the control circuit. Every machine locates and clamps the part for the machining operations, transfers it from station to station, and finally, at the end of the cycle, pushes it onto the loading platform of the next machine.

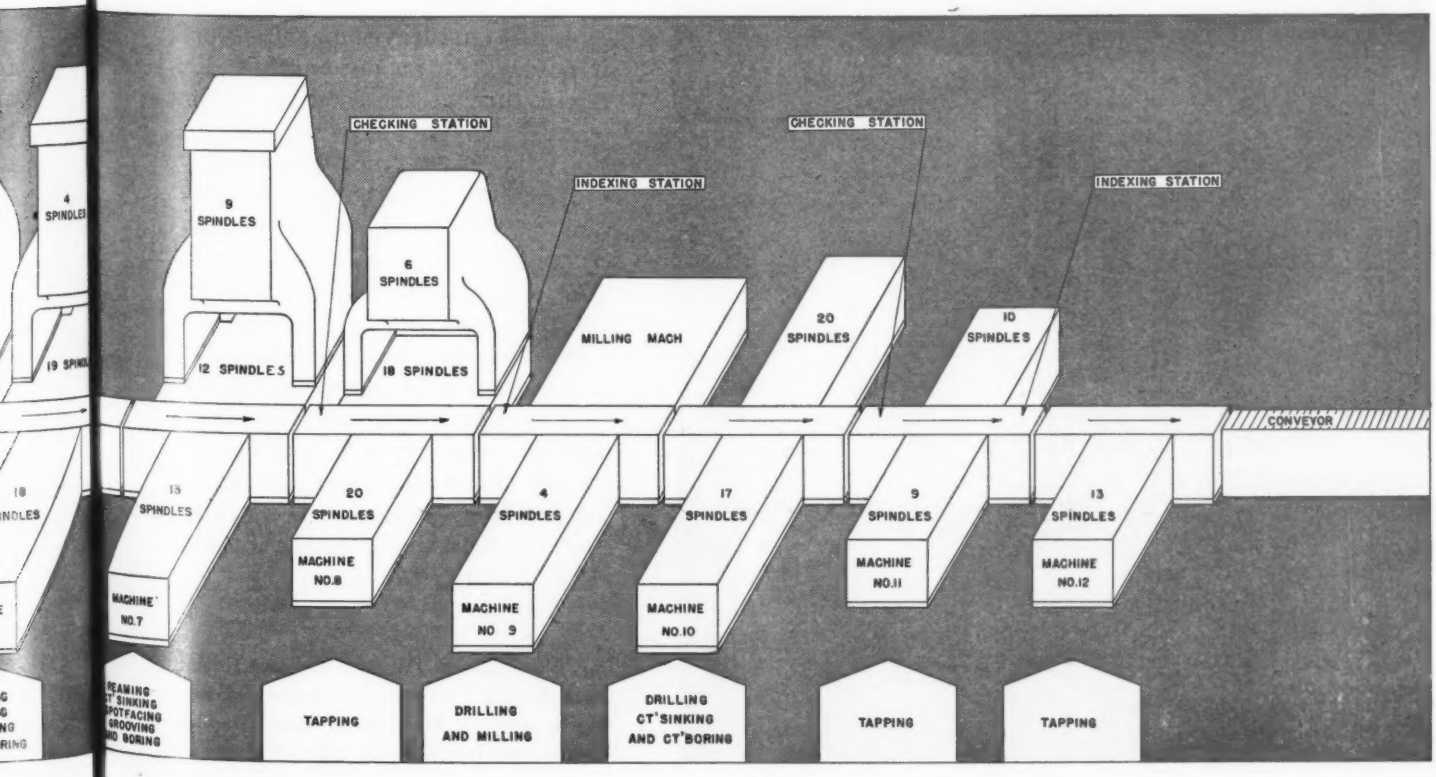
At the operator's loading station one push-button controls the cycle stop; this control allows each machine to complete its cycle and then shut itself off. There are also individual control panels for each machine, and since each unit must be started individually by the operator, he is forced to inspect the units and tools along the line, and therefore is more likely to discover any defect in the set-up than if all machines operated from a centralized control.

With all machines running, the operator loads a part on the first machine, thus automatically closing a limit switch and signifying that there is a part in the loading staton, ready to be transferred. When a transfer unit reaches the end of its cycle, another limit switch is tripped, the transfer bar of the next unit moves into the loading position, the part is unclamped, and the locating pins are retracted. The loading station of the following machine must be empty, ready to receive the part from the preceding machine. This means that the complete line-up must be timed to the slowest operation being performed on the part.

The transfer pins are raised in back of the parts to be transferred and a transfer bar brings the new part into position; at the same time, the completed part is pushed onto the loading station of the next machine. With the part in position, the locating pins are inserted and the part is clamped. Limit switches on the bushing plate, which are tripped when the part is clamped, start the unit cycle.

Transfer Machine for Automotive Transmission Cases

The transfer line seen in Fig. 1 and in the diagram, Fig. 2, was designed for machining the automotive transmission case shown in Fig. 3. Consisting of twelve stations, eleven of which



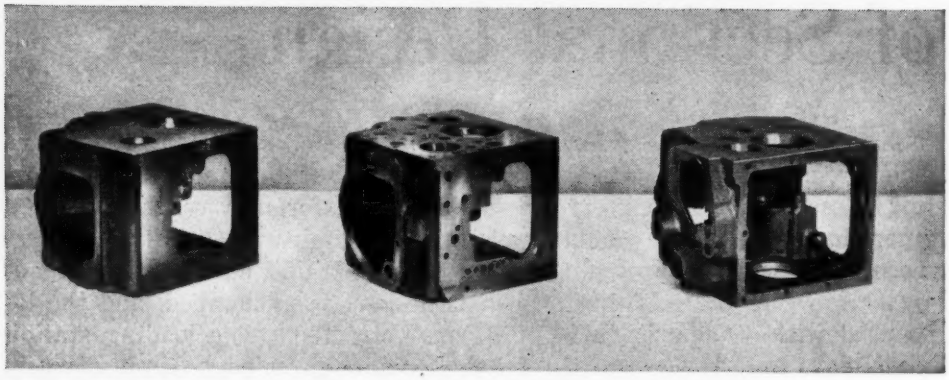


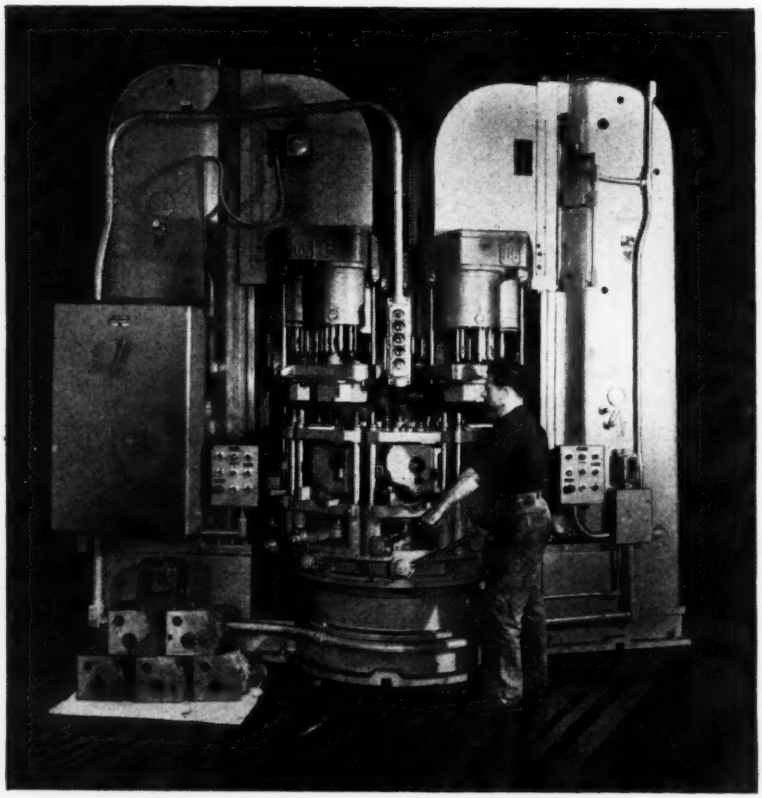
Fig. 3. An Automotive Transmission Case prior to Machining Operations (Left) and after Passing through the Transfer Machine (Center and Right)

are incorporated in the transfer line, this set-up performs 369 operations on one transmission case at a production rate of 45 cases per hour. Fig. 1 shows machines Nos. 2 to 8, inclusive. The schematic diagram, Fig. 2, illustrates the arrangement of the line and the flow of work.

The initial operations, performed on the double-post vertical drilling machine shown in Fig. 4, consist of drilling and reaming the holes that are used for locating purposes in subsequent steps, and drilling, reaming, countersinking, and counterboring the valve-block face of the transmission case. Upon the completion of this machining cycle, the work is checked in an automatic fixture and then placed in machine No. 2, (shown in Fig. 5), which is the first machine in the transfer line.

The part is positioned at the loading station of this machine with the valve face down; as it progresses along the line from machine No. 2 to machine No. 8, various operations are performed on the front, rear, and side faces. The first two machines, which are two-way horizontal types, work on the front and rear faces only. The next four units machine all but the valve face, and machine No. 8 taps the holes. An automatic checking fixture is located at the loading station of the latter unit to gage the hole locations prior to the tapping operations.

All of the horizontal units on machines No. 2 through No. 7 have an 18-inch stroke, while all of the vertical units on machine No. 4 through No. 7 have a 12-inch stroke. Each of the units is self-contained, having its own hydraulic pump and cylinder. Machine No. 8 consists of three stationary individual lead-screw tapping units, each of which is provided with a fixed-center individual lead-screw spindle head.



Indexing Fixtures

As the part leaves machine No. 8, it passes into an automatic indexing fixture at the loading station of machine No. 9, which indexes the part 90 degrees horizontally, thus bringing the bottom face and the top face into position for machining. At this machine a special unit mills the top face while the drilling operation is being performed on the bottom face. The part is then transferred to machine No. 10, where the holes are countersunk, after which it passes to an automatic checking fixture at the loading station on machine No. 11, where the holes are checked prior to being tapped.

Fig. 4. Machine No. 1 Drills and Reams the Locating Holes for Subsequent Operations, and Drills, Reams, Countersinks, and Counterbores Valve Side of the Case

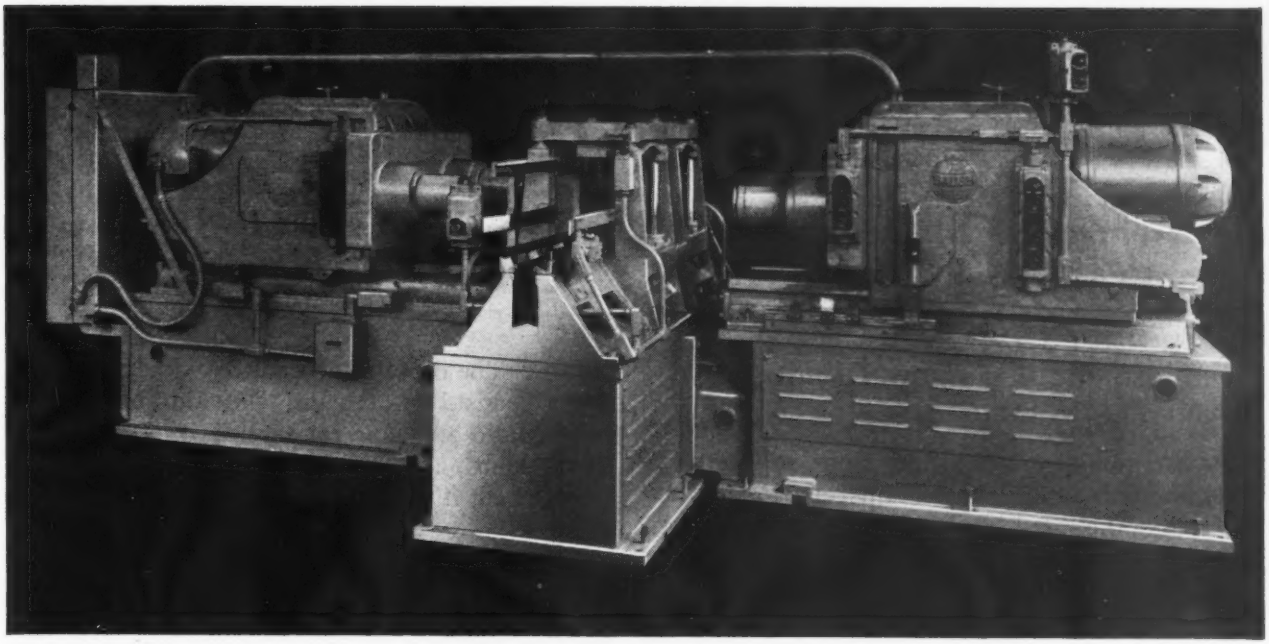


Fig. 5. Machine No. 2, the First Unit on the Transfer Line, is a Two-way Horizontal, Multi-spindle Unit that Bores the Front and Rear Faces of the Transmission Case

Another automatic indexing fixture is located at the loading station of machine No. 12, which indexes the part 90 degrees vertically to bring the valve face into position for tapping. Machine No. 12 is a single-way individual lead-screw tapping machine located at the right-hand side of the transfer machine line-up. After the valve face has been tapped on this machine, the work is transferred onto the conveyor.

All of the units in the transfer machine line-up (machines No. 2 through No. 12) are arranged with two working stations and a loading station. The columns for the vertical units are arched to provide clearances for the horizontal units working on the rear face. In addition, a clearance of 30 inches is provided between the machines to allow ample room for tool setting on both the horizontal and vertical heads.

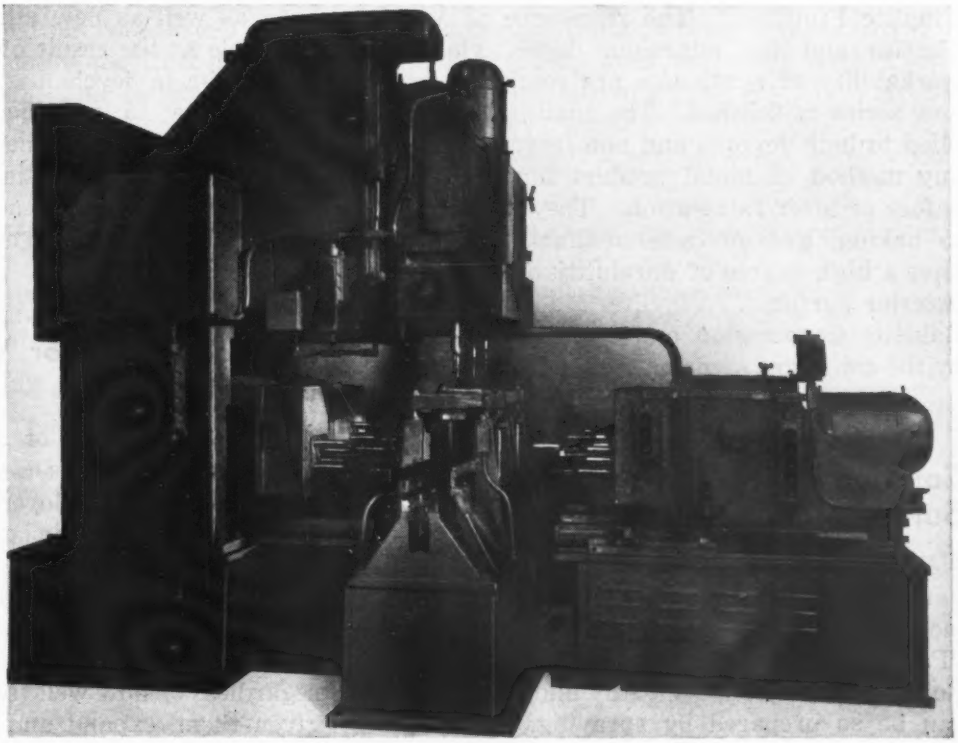


Fig. 6. The Front, Rear, and Side Faces are Drilled, Countersunk, and Counterbored on Machine No. 4. Fifty-four Spindles are Incorporated in the Three Heads

Materials of Industry

THE PROPERTIES AND NEW APPLICATIONS OF MATERIALS USED IN THE MECHANICAL INDUSTRIES

Seamless Molybdenum Tubing Now Available to Industry

Development, for the first time, of seamless molybdenum tubing in commercial quantities has been announced by the Callite Tungsten Corporation, Union City, N. J. The tubing is now being manufactured in sizes ranging from 0.040 to 0.500 inch outside diameter and in lengths up to 9 inches.

Molybdenum tubing can readily be machined, is easily worked and shaped within reasonable tolerances, and can be welded to iron, nickel, and similar materials. It has the advantage of not being affected by hydrofluoric acid, potassium or sodium hydroxide. 201

Vinylite Finishes with Wide Range of Application

The Watson-Standard Co., Pittsburgh, Pa., is now manufacturing an extremely versatile group of technical coatings known as "High Solids Vinylite Finishes." The resistance of Vinylite plastics and the adhesion, depth, gloss, and workability of synthetics are combined in this new series of finishes. The coatings can be applied to both ferrous and non-ferrous metals by any method of metal product finishing, either before or after fabrication. They are adaptable to baking, and produce brilliant finishes that have a high degree of durability on interior and exterior surfaces. Vinylite is a trade name of Bakelite Corporation and its use is sanctioned by the copyright owner. 202

Solution that Prepares Aluminum Surfaces for Painting

A simple, fast, and economical method of preparing aluminum and its alloys for painting or lacquering is the use of a solution known as "Paintbond," developed by the Colonial Alloys Co. of Philadelphia, Pa. Any alloy of aluminum can be so prepared by spraying, brushing, or dipping. The dipping procedure, which is preferable, consists of freeing the aluminum from greases and dirts and immersing it in the "Paintbond" solution for about thirty to sixty seconds, after which it is rinsed and dried. 203

New Cleaning Compounds Announced by Houghton

E. F. Houghton & Co., 303 W. Lehigh Ave., Philadelphia 33, Pa., announce a new series of metal cleaning compounds that are known as the "Houghto-Clean 200 Series." This series of compounds embodies seventeen different products, including cleaners for maintenance work, for ferrous and non-ferrous metals, for use prior to painting or vitreous enameling, electrolytic cleaners, and special-purpose compounds.

Each of these products is said to be a new formulation, and not a mere revision of former products. Thus, new synthetic detergents, which have proved superior in many ways to soap itself, have been utilized in several of these products, as well as new alkalies that have become available as the result of wartime research.

The aim in developing the Houghto-Clean 200 Series was to provide increased speed and greater efficiency so that alkaline cleaning can be used in the production line with a considerable saving of time, as compared to former practice. 204

Plastic Covers for Wooden Stretching Dies

The performance of a Fiberglas-resin, low-pressure laminate as a cover for a hard-wood stretching die employed by the Flxible Co., Loudonville, Ohio, in drawing steel for bus, ambulance, and funeral car bodies, has led to a decision by the company to cover all of its stretching dies with a similar laminate. Experience has shown that uncovered hard-wood dies, regardless of how well they are made or the care given them, expand and contract with changes

in climatic conditions, and over a period of time are subject to considerable wear. Thus, it has been necessary to rework the uncovered dies for approximately every lot of fifty panels.

The Fiberglas-resin cover has provided dimensional stability under all climatic conditions encountered, and has been used for over five hundred panels with no appreciable wear. Eight plies of Fiberglas cloth were used in forming the laminate. 205

Precision-Ground Flat Stock Made in Wide Size Range

Flat steel stock, precision ground to within 0.001 inch of the specified thickness, is now being made available in a wide range of sizes by the Capewell Mfg. Co., 60 Governor St., Hartford 2, Conn. This stock is manufactured from electric furnace steel, is annealed for easy machining, and has a carbon and alloy content that permits hardness up to 66 Rockwell C to be obtained by oil- or water-hardening. In addition to the sizes usually offered in this type of material, 18-inch lengths that are 5/16, 3/8, and 1/2 inch thick by 5 to 6 inches wide, and 18-inch lengths that are 5/8 and 3/4 inch thick and from 1 to 6 inches wide, are available. 206

Unusual Cellulose Gum Has Many Useful Properties

A cellulose derivative with a unique combination of properties indicating widespread applications is a recent product of the Hercules Powder Co., Wilmington, Del. This cellulose gum is water soluble, and yet can be made relatively water insoluble; it is adhesive, but not sticky; it is insoluble in organic solvents; forms tough films; and not only acts as an emulsifying agent in oil and water emulsions, but also protects the emulsion.

This compound, called CMC, greatly increases the viscosity of water, and it is also possible to carefully control the viscosity of any solution in which it is used. It is relatively non-hygroscopic, both in solution and film, and is compatible with many water-soluble materials such as gums, plasticizers, and resins. 207

Plastic Barrel Developed for Metal Plating

An outstanding illustration of the solving of industrial production problems by the use of plastics is a newly developed plating barrel made of du Pont "Lucite" acrylic resin and originated by the Hardwood Line Co., of Chicago, Ill. The barrel is used for metal plating by the tumbling method. Objects to be plated are held in a perforated container, which is dipped and revolved in a vat containing the plating solution.

The new barrel is hexagonal, and is mounted on a moving stand, which allows the machine—gears and all—to be lowered into the solution vat. The gears are constructed of Lucite, as well as the barrel itself. The plastic is resistant to the acid used in the plating bath.

A disadvantage of the hard rubber barrels previously used was that they became ionized in use, and the solutions, in time, became plated on the rubber. This does not occur with Lucite, which is chemically inert. 208

To Obtain Additional Information on Materials of Industry

To obtain additional information about any of the materials described on these pages, fill in below the identifying number found at the end of each description—or write directly to the manufacturer, mentioning name of material as described in June, 1947, MACHINERY.

No.	No.	No.	No.	No.	No.	No.	No.	No.	No.

Fill in your name and address on the blank below. Detach and mail within three months of the date of this issue to MACHINERY, 148 Lafayette Street, New York 13, N. Y.

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Tour of New Motor Plant Highlights Westinghouse Electrification Forum

THE eleventh annual Machine Tool Electrification Forum of the Westinghouse Electric Corporation was held in Buffalo on April 22 and 23. Buffalo was selected for this occasion in order to give the three hundred or more engineers and executives of the machine tool industry, in addition to the large number of Westinghouse engineers in attendance, an opportunity to visit the new Westinghouse plant in that city. This plant, incidentally, is the second largest of all the Westinghouse plants. Some of the forum sessions were held at the new plant.

As at past sessions of the forum, the program consisted of a variety of papers dealing with electrical developments of especial importance to the machine tool industry and addresses of general interest to that field. In his address, L. E. Osborne, senior vice-president in charge of operations, Westinghouse Electric Corporation, stressed the importance of machine tools to all branches of the metal-working industry and emphasized the fact that manufacturers in that industry are looking to machine tool builders for equipment to help overcome present handicaps of high labor and material costs.

Two of the papers dealt with electrification problems pertaining to multi-purpose station type machines. One of these, "Electric Controls for Multi-Purpose Machines," was read by J. H. Mansfield, chief engineer, Greenlee Bros. & Co., who also presented a motion picture dealing with various machines of the classification mentioned which have been built by his concern. The other paper on this subject, "Wiring System for Station Type Drilling Machines," was read by R. C. Heinmiller, electrical engineer, Foote-Burt Co. Additional papers presented at the first session were: "D-C Motor with Rectifier Power Supply," by E. C. Watson, Motor Engineering, Westinghouse Electric Corporation; and "Machinery

Fig. 1. Hubs are Welded to the Stamped Steel Brackets of "Life-Line" Motors by the Submerged-arc Process on an Automatic Westinghouse Machine. The Weldments are Washed and Painted before being Placed on Conveyor in Fig. 3

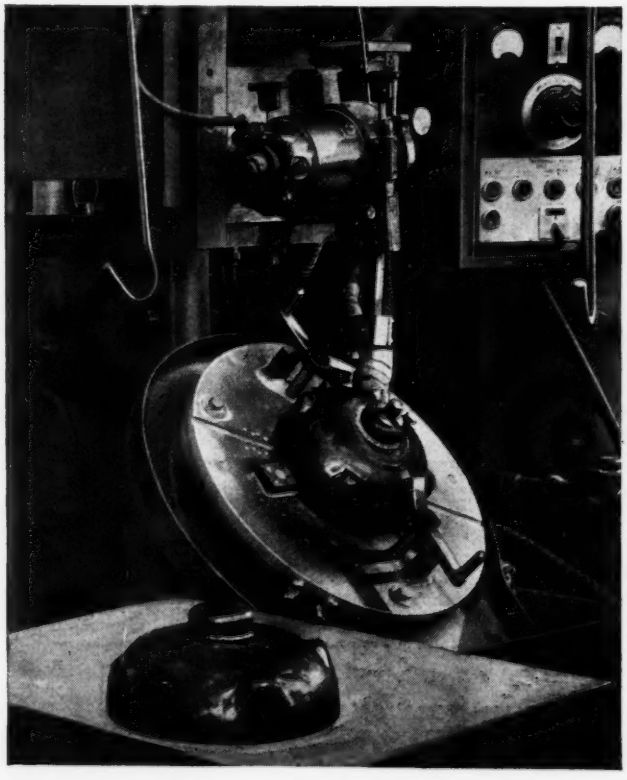


Fig. 2. Close-up View of Tooling Provided on an Acme-Gridley Automatic Chucking Lathe for Performing Turning, Boring, and Facing Operations on the Motor Brackets. These Operations are Performed in One Minute Five Seconds per Piece

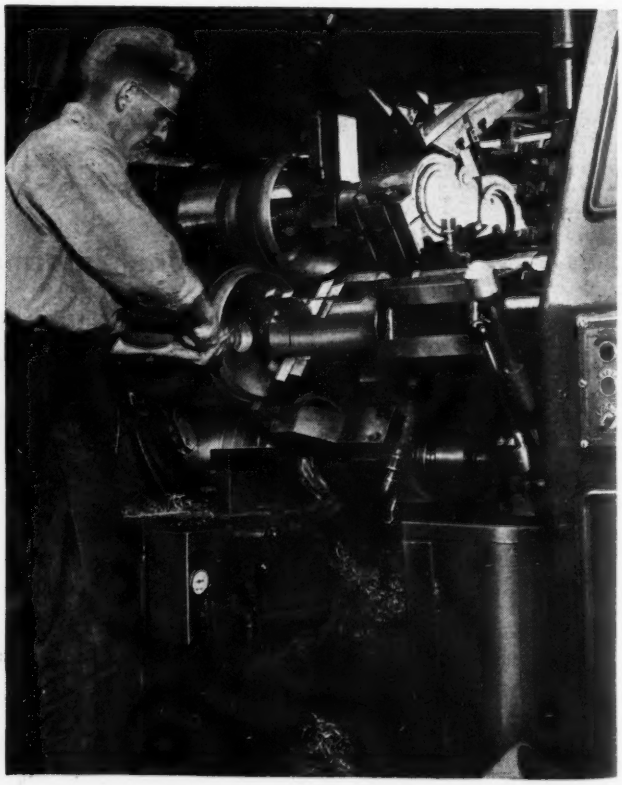


Fig. 3. The Pressed and Welded Motor Brackets are Carried by Gravity Conveyor to an Acme-Gridley Automatic Chucking Lathe for the Performance of Five Operations on the Bearing and Shaft Bores, Rabbet Fit, and Face

Electrification for Increased Sales," by G. A. Spohn, King Machine Tool Co.

"A New Drive for a New Machine for a New Technique" was the subject of a paper presented jointly by W. E. Happel, electrical engineer, Landis Tool Co., and M. S. Gjesdahl, professor of mechanical engineering, Pennsylvania State College. Another paper read on the first day of the forum was "Breakers vs. Fuses for Branch Circuit Fusing," by L. W. Herchenroeder, Industry Engineering, Westinghouse Electric Corporation. Activities on the first day also included a report of the Electrical Committee of the National Machine Tool Builders' Association and sessions dealing with automotive and NEMA standards.

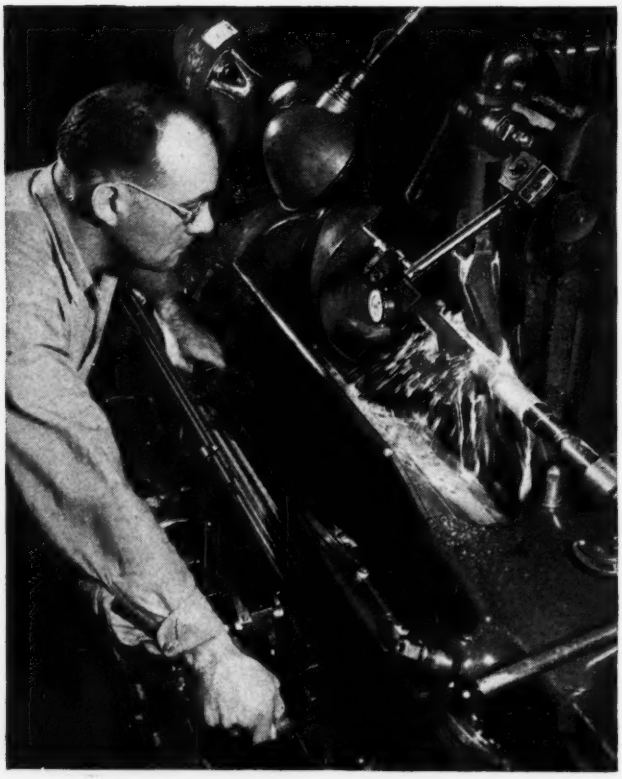
The papers presented on the second day of the forum were: "Higher Ratings for Totally Enclosed, Non-Ventilated Motors with High-Temperature Insulation," by W. H. Formhals and G. P. Gibson, Motor Engineering, Westinghouse Electric Corporation; "Modern Manufacture of

Fig. 4. Welding Seam of Rolled-steel Motor Frame by Submerged-arc Process on a Special Machine. The Frame Ring is Located on the Fixture Hydraulically and is Securely Held by Air-operated Clamps. The Operation is Automatic

Fig. 5. Rotor Laminations are Punched from the Center of Stator Laminations. This Photograph Shows Bliss Inclined Punch Press that Punches Slots in Rotor Laminations. As They Leave the Machine, They are Automatically Stacked

Fig. 6. (Above) The Stator Cores are Built up and Assembled with the Motor Frame and End-plates on a Watson-Stillman Triple-action Hydraulic Press. When the Motor Leaves This Press, It is Ready for Final Machining

Fig. 7. (Below) Motor Shaft Surfaces for Bearings and Pulleys are Ground Accurately to Size on a Cincinnati Plunge-cut Cylindrical Grinding Machine. The Shafts are Ground to Five Different Diameters in One Operation



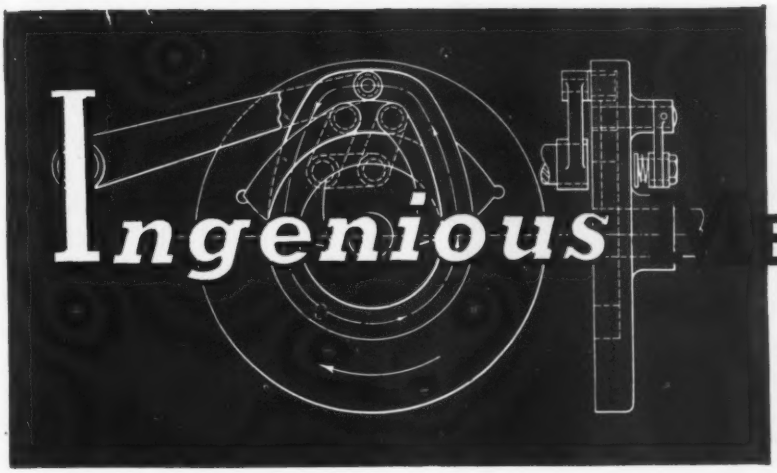
Electric Motors," by T. C. Fockler, manager, A-C Engineering, Westinghouse Electric Corporation; and "Report on Machine Tool Industry," by Tell Berna, general manager, National Machine Tool Builders' Association.

The speaker at the annual banquet was Alexander G. Bryant, vice-president, Cleereman Machine Tool Co., and first vice-president, National Machine Tool Builders' Association, who took as his subject "Better Machine Tools for Better Living." L. D. Bell, president, Bell Aircraft Corporation, discussed problems of supersonic flight at a luncheon.

One of the highlights of the forum was a tour

Fig. 8. The Rotor Core, Shaft, and Blower Assembly for "Life-Line" Motors are Accurately Balanced on a Gisholt Dynetric Balancing Machine. When Additional Weight is Required, Steel Washers are Riveted to Cast Lugs between the Fan Blades on Each End

through the manufacturing and assembly lines of the new plant producing "Life-Line" motors. Much of the machinery in this new plant was moved from the East Pittsburgh Works without loss of production. The main floor of the plant is 2010 by 600 feet, the total area under one roof being approximately 1,860,000 square feet. The floor area including outside buildings is over 2,000,000 square feet. In addition to motors, control and welding equipment and other products will eventually be made at this plant.



Ingenious MECHANISMS

Mechanisms Selected by Experienced Machine Designers as Typical Examples Applicable in the Construction of Automatic Machines and other Devices

Mechanism for Automatically Stopping Press when Stock Fails to Feed

By F. H. MAYOH

A certain press operation involves the feeding of two steel strips from rolls into the forming station of the machine, where pieces are cut off from each strip and assembled in automatic dies. To avoid material waste caused by failure of either strip to feed, due to a break in the material or completion of the roll, it was necessary to develop the electrically operated, automatic stop mechanism here described. With this mechanism, the positive clutch of the press is automatically tripped, thus stopping the machine, when either of the strips fails to feed. Modifications of the mechanism can be made to accommodate other types of clutches.

As shown in Fig. 1, the two steel strips *X* and *Z*, being fed in the direction indicated by the arrows, are contacted by rolls *A* and *B*, respectively. These rolls, mounted on bellcranks *F* and *E*, are held against the strip stock by springs *C* and *D*. The feeding mechanism (which is not shown) draws the thin strips over idler roll *M*, thus increasing the tension of the strips. The bellcranks pivot about shaft *G*, which is supported in the U-shaped bar *H* that hangs from plate *J*. This plate is fastened to block *K*, which is mounted on spindle *L* of the machine through which the strips pass.

The upper arms of bellcranks *E* and *F* are fitted with screws *V* that make contact with

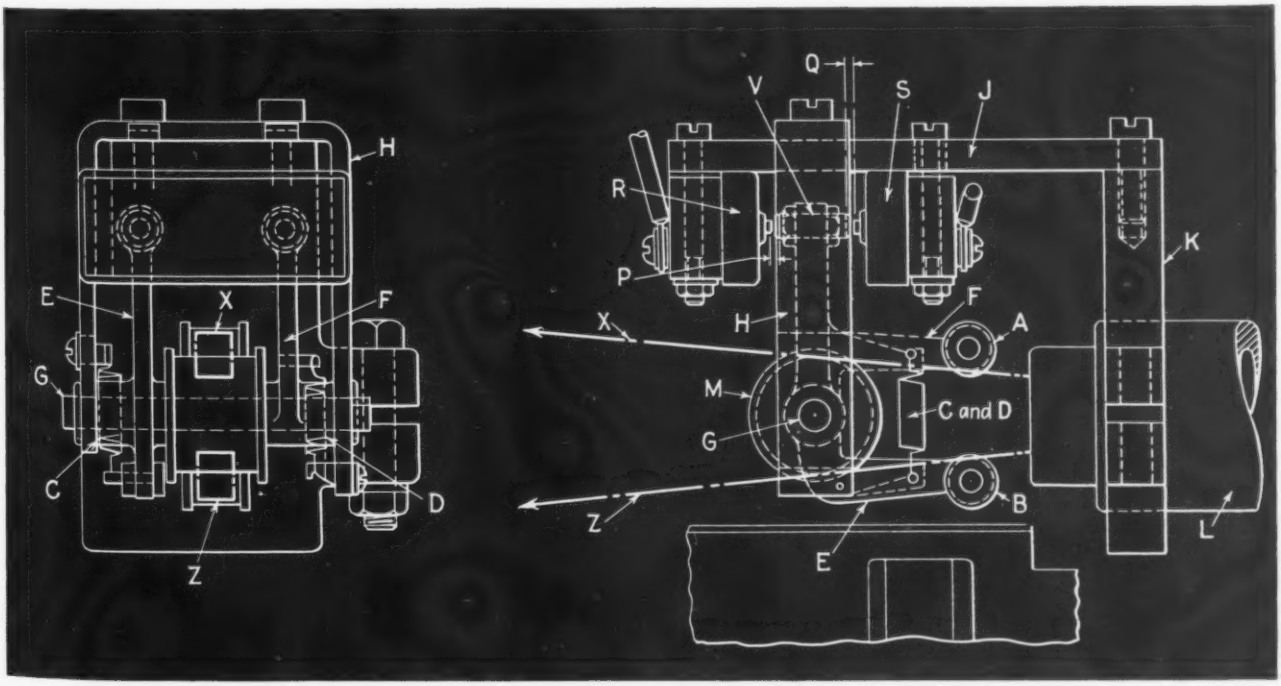


Fig. 1. A Forming Press is Automatically Stopped by Means of This Mechanism and the One Shown in Fig. 2 when Either of the Strips X and Z Fails to Feed

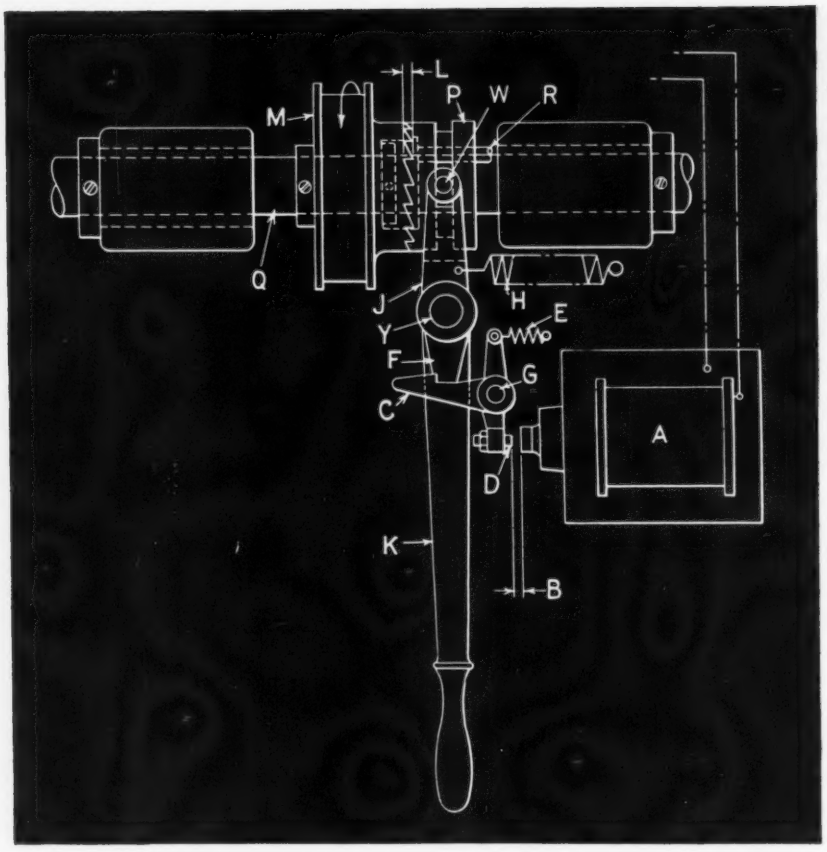


Fig. 2. The Teeth of Clutch P are Automatically Disengaged from Those on the Hub of Pulley M when the Electrical Circuit to Solenoid A has been Completed, thus Stopping the Press when the Strip Stock Fails to Feed

either of the normally open switches *R* and *S* when the feeding of the strips is interrupted. This closing of the electrical circuit is accomplished through movement of bellcrank *E* or *F*, by spring *C* or *D*, depending upon which steel strip is broken, thus causing one of the screws *V* to close gap *P* or *Q*. The switches are electrically connected to solenoid *A*, Fig. 2.

Referring to Fig. 2, when the electrical circuit to solenoid *A* has been completed, the contact point *D* will be moved toward the solenoid, closing gap *B*. This movement causes pawl *C* to pivot about stud *G*, thus releasing the end of pawl *F*. Spring *H*, which is connected to yoke end *J* of pawl *F*, then pivots the pawl around shaft *Y*, thus pulling the clutch teeth out of engagement at *L* and causing the machine to stop.

Pulley *M* rotates in the direction indicated by the arrow, and is held in position on shaft *Q* by collars. Clutch *P* is keyed to the shaft, and when the teeth of the clutch are in engagement with those of the pulley, key *R* causes the shaft to revolve. When the teeth are disengaged, the pulley is free to rotate on the stationary shaft. Pins *W* in yoke *J* fit in the groove in the clutch. The clutch can be re-engaged by lever *K*.

Technical Societies Council of New York

Engineers in the New York metropolitan area will be interested to know of the organization of the Technical Societies Council of New York. The Council, an outgrowth of a war production committee that had been disbanded at the end of the war, has as its main objects the advancement of engineering, scientific, or technical knowledge and the practice of high professional standards. It is composed of engineering and technical societies in Greater New York.

The fourteen charter members include: American Institute of Chemical Engineers, American Institute of Electrical Engineers, American Institute of Mining and Metallurgical Engineers, American Society of Heating and Ventilating Engineers, American Society of Mechanical Engineers, American Society for Metals, American Society of Safety Engineers, American Society for Testing Materials, American Society of Tool Engineers, American Chemical Society, American Welding Society, Illuminating Engineering Society, Institute of Radio Engineers, and Society of Motion Picture Engineers.

* * *

Charles Bruning Co. Celebrates Fiftieth Anniversary

Charles Bruning Co., Inc., Chicago, Ill., manufacturer of sensitized papers, blueprinting and black and white print equipment, and other drafting-room equipment, is celebrating the fiftieth anniversary of the founding of the company this year. It was in 1897 that Charles Bruning founded a small blueprinting shop in New York. Within a short time, the company was sensitizing and selling its own blueprint paper. From this small beginning the business has expanded to national scope, with branches throughout the United States.

One of the outstanding achievements of the company was the introduction in 1929 of the black and white direct-line process for making prints directly from tracings without a negative.

Tool Engineering Ideas

Tools and Fixtures of Unusual Design, and Time- and Labor-Saving Methods that Have been Found Useful by Men Engaged in Tool Design and Shop Work

Self-Centering Reaming Fixture for Spinning Caps

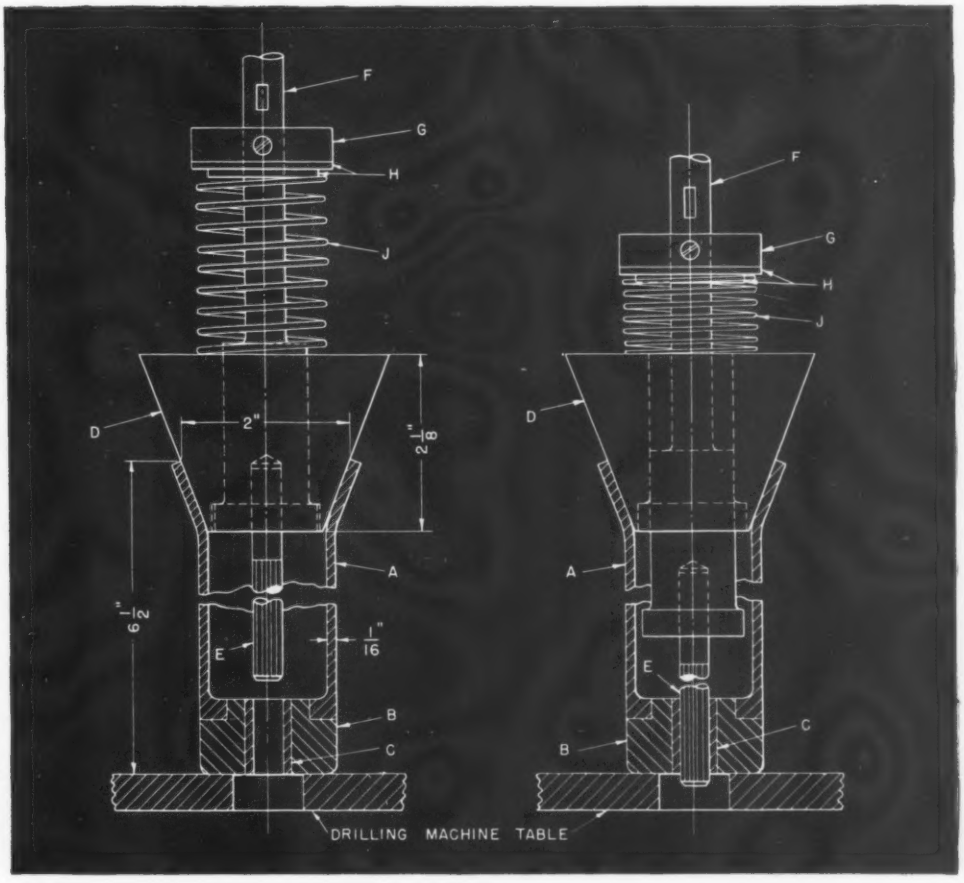
By ROBERT MAWSON, Providence, R. I.

Although extreme accuracy is not necessary in making many of the elements used in textile machines, the machining and assembling of certain parts must be done with practically toolroom accuracy. One example of such a part is the spinning cap shown in the accompanying illustration. This cap is used on textile machines of the type manufactured by John W. Collier & Son. It consists of a steel shell *A*, in which a cast-iron plug *B* is inserted, and a bronze bushing *C* which is forced into the cast-iron plug.

After the parts of this cap have been assembled, they are accurately machined and the steel shell is polished both inside and outside. A hole is also drilled through the bushing *C* which is later reamed to a diameter of 3/8 inch. In order to insure proper functioning of the spinning cap, the 3/8-inch reamed hole must be concentric with the inside tapered section of the shell.

The special reaming tool designed to meet these requirements is shown at the left in the illustration in the work-locating position and at the right in the finish-reaming position. This tool consists of a member *D* machined to the same taper as the mouth of the spinning cap *A*. In shank *F* is mounted a reamer *E* of the correct diameter. The tool is held in the spindle of a vertical drilling machine. On shank *F* are also mounted spring *J*, a spring-retaining and tension-adjusting collar *G*, and a washer *H*.

In performing the reaming operation, a spinning cap is placed on the table of the drilling machine and held by hand with the aid of a machine dog. The reamer is fed down inside the spinning cap while the tapered surface of the locating member *D*, coming in contact with the inner surface of the mouth of the cap *A*, centralizes the work, thus insuring that the hole in bushing *C* will be machined concentric within the required limits of accuracy.



Reaming Tool and Centering Fixture Used in Drill Press for Reaming Hole in Bushing C

When the tool is withdrawn after completing the reaming operation, the tension of spring *J* is released, facilitating the removal of the tool from the spinning cap.

Simple Device for Radius or Profile Turning

By DONALD BAKER, Boonton, N. J.

A simple profiling device recently was used to obtain large-lot production of the small brass part *X* shown in the accompanying illustration. The work was required to have a fine surface finish and be free of tool marks. The job was accomplished in an Atlas lathe as follows:

First, a master form plate *A* of 1/16-inch, cyanide-hardened sheet metal was doweled to block *B*, as shown at *Y*. The block was then bolted to the bed of the lathe, and squared up under the work as shown at *Z*. A chisel-pointed follower *C*, made of 3/16-inch drill rod, was rounded off with an oilstone so as to provide smooth contact with the form plate. After a hole was drilled and reamed in the bottom of the compound slide *D*, follower pin *C* was driven in and set on the center line of the form plate. With a tool placed in the toolpost and set at the center of the work and the compound slide swung parallel with the ways of the lathe, the compound slide was adjusted for correct depth of cut. Then, by manipulating the cross-feed and carriage to keep the follower pin in contact with the form plate, the required profile was easily machined.

Tool for Aligning Lathe Tailstock with Work in Chuck

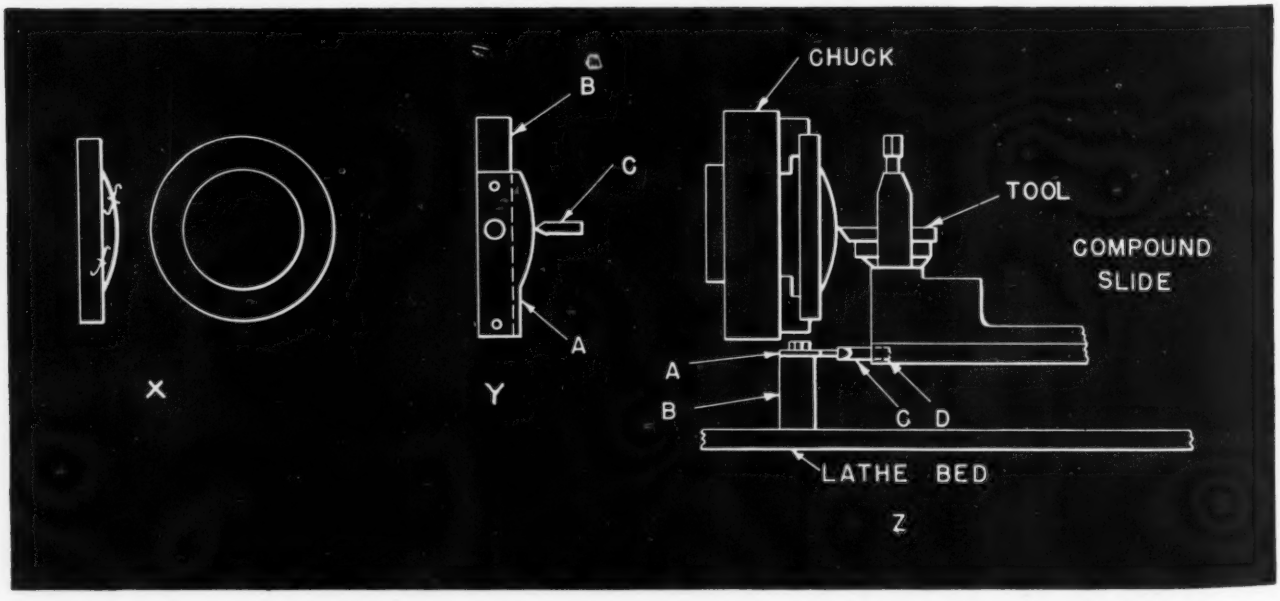
By H. MOORE, Leeds, England

A tool mounted in the tailstock of a lathe will not cut the work-piece accurately unless the tailstock is properly aligned with the work-piece. The frequent moving of the tailstock from its aligned position to accommodate taper work, and the difficulty of determining when the tailstock and headstock centers are again aligned, are reasons why lathe tailstocks are frequently off center.

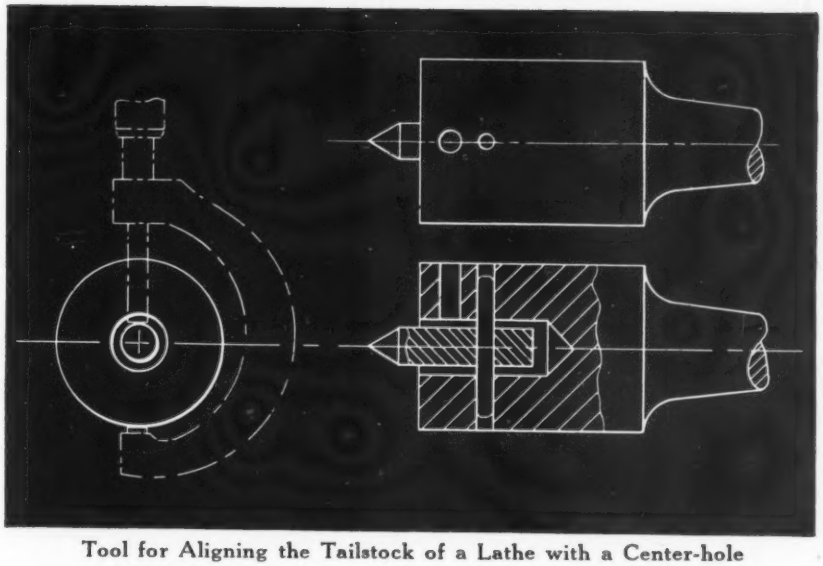
There are a number of accepted methods of aligning headstock and tailstock when both centers are in place. The tool here illustrated facilitates such alignment when the work is in position in the lathe chuck. The only testing point required is a true center-hole in the work. With such a center-hole, a misalignment of 0.001 inch can be easily detected.

The alignment tool consists of three parts—a body which fits into the tailstock spindle; a pin which slides radially through the body; and a dead center which is drilled to provide a tight fit for the pin, as shown. The flat end of the body is drilled to provide clearance for various positions of the dead center. Another hole is drilled radially in the body between the slide pin hole and the front face of the body to provide clearance for the stem of a micrometer.

To test the center-hole of the work-piece, the tool is placed in the tailstock spindle with the slide pin in a horizontal position, and the tailstock is advanced until the dead center enters



In Order to Increase Production of the Brass Part X, a Form Plate A was Mounted on a Standard Lathe and Used in Conjunction with a Profiling Device, as Shown at Z



Tool for Aligning the Tailstock of a Lathe with a Center-hole in the Work-piece while the Work is Mounted in the Headstock

the center-hole. A micrometer is then placed in the position shown, with the anvil on the body of the tool and the stem in contact with the dead center.

The reading of the micrometer will depend upon the dimensions to which the tool has been made. Assuming the diameter of the body to be 2.000 inches, and the diameter of the dead center to be 0.500 inch, then the micrometer will show a reading of 1.250 inches if the tailstock is accurately aligned. Any variation from this dimension represents the amount of error in the alignment of the tailstock. After checking the alignment in this position, the tool can be turned 90 degrees to bring the slide pin to a vertical position for checking the vertical alignment of the tailstock.

Versatile Work-Holding Device with Adjustable Clamping Pressure

By MARK W. PURSER, Tenafly, N. J.

A work-holding device that can be easily adapted for clamping parts of various shapes during machining operations is shown in the accompanying illustration. It can be constructed quickly and economically.

Referring to the illustration, the plunger *B* is a sliding fit in body *G*. Two pins *F* are a press fit in the button head *A* of the plunger and a sliding fit in the body. These pins prevent the plunger from rotating with respect to the body.

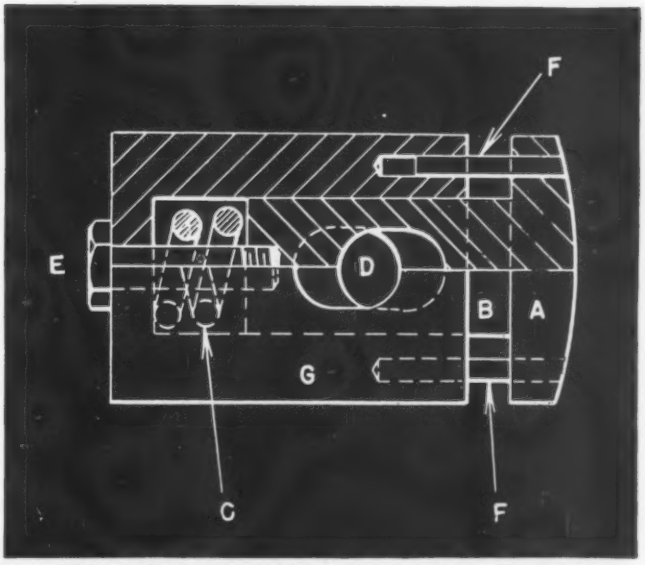
Elongated holes in the body and plunger form opening *D*, in which the work-piece is clamped through pressure exerted on the plunger by the spring *C* when the hand pressure on the button head *A* is released. The tension of the spring *C* can be adjusted by tightening or loosening bolt *E*, thus increasing or decreasing the pressure with which the part is clamped.

The openings in the clamping jaws can be made square, hexagonal, V-shaped, or any other shape to suit projections or holes on the work-piece. Replaceable jaw inserts of various shapes can also be made for this fixture to increase its versatility.

* * *

New Abrasive Selector Simplifies Sanding and Finishing Procedures

The Sterling Tool Products Co., Chicago, Ill., manufacturer of portable electric sanders, has made available a slide-rule type abrasive selector which indicates the correct kind of abrasive to use for a job; abrasive grit sizes for various finishing operations on different types of material; type of coating—open, closed, waterproof, etc.; lubricant to be used; and proper pad to be employed on the sander. The device indicates the correct abrasive combinations for 120 specific sanding and finishing jobs. Copies are available through Sterling distributors at a nominal cost.



Work-holding Fixture that can be Easily Adapted for Clamping Parts of Different Shapes. The Clamping Pressure is Adjustable

Automatic Molding of Thermosetting Plastics

THERMOSETTING plastic parts are now being produced automatically by a single machine which performs seven progressive steps covering the preforming, preheating, molding, and curing operations for which three or more machines are ordinarily employed. The "Hy-Jector" automatic molding machine shown in Fig. 1, on which this work is being done, performs the seven operations indicated diagrammatically in Fig. 2 without any attention from the operator other than starting the machine and removing the molded parts. The Rockford Machine Tool Co., builder of the machine, has equipped it with accurate automatic time controls for each stage in the operating cycle. The interlocked electronic controls and timers are adjustable to meet all requirements and to make possible accurate production control.

In addition to higher production speed, many important advantages are claimed for this process. Finished parts, for example, are said to be uniform in quality and free from blisters and porosity. By injecting the material into a closed mold, flash is held to a minimum. Close timing of the preheat molding stage permits low molding pressures, and as a result, the die design can be simplified and die wear held to a minimum.

When the molding machine is in operation, the material is fed by gravity from the hopper shown at *A*, Fig. 2, into the measuring chamber. The chamber is adjustable for any amount of material up to 8 ounces, and assures automatic selection of the exact amount of material for which it is set. This serves to eliminate waste and contamination of the material. Forward travel of the measuring chamber piston in the cylinder shuts off the feed from the hopper, as shown at *B*, and carries the material to the throat of the preforming cylinder. The material is fed by gravity from this point through the throat into the preform cylinder.

The preform cylinder and mechanism, shown at *C*, are an integral part of the machine. The actual position of the preform cylinder is beneath and at right angles to the measuring cylinder. When material enters the preform cylinder, the plunger moves forward, compressing the material into a preform, as indicated at *D*. Adjustable pressure control of the plunger assures compressing the preform to the correct density. From the preform cylinder, the formed material is carried automatically into the dielectric heat-

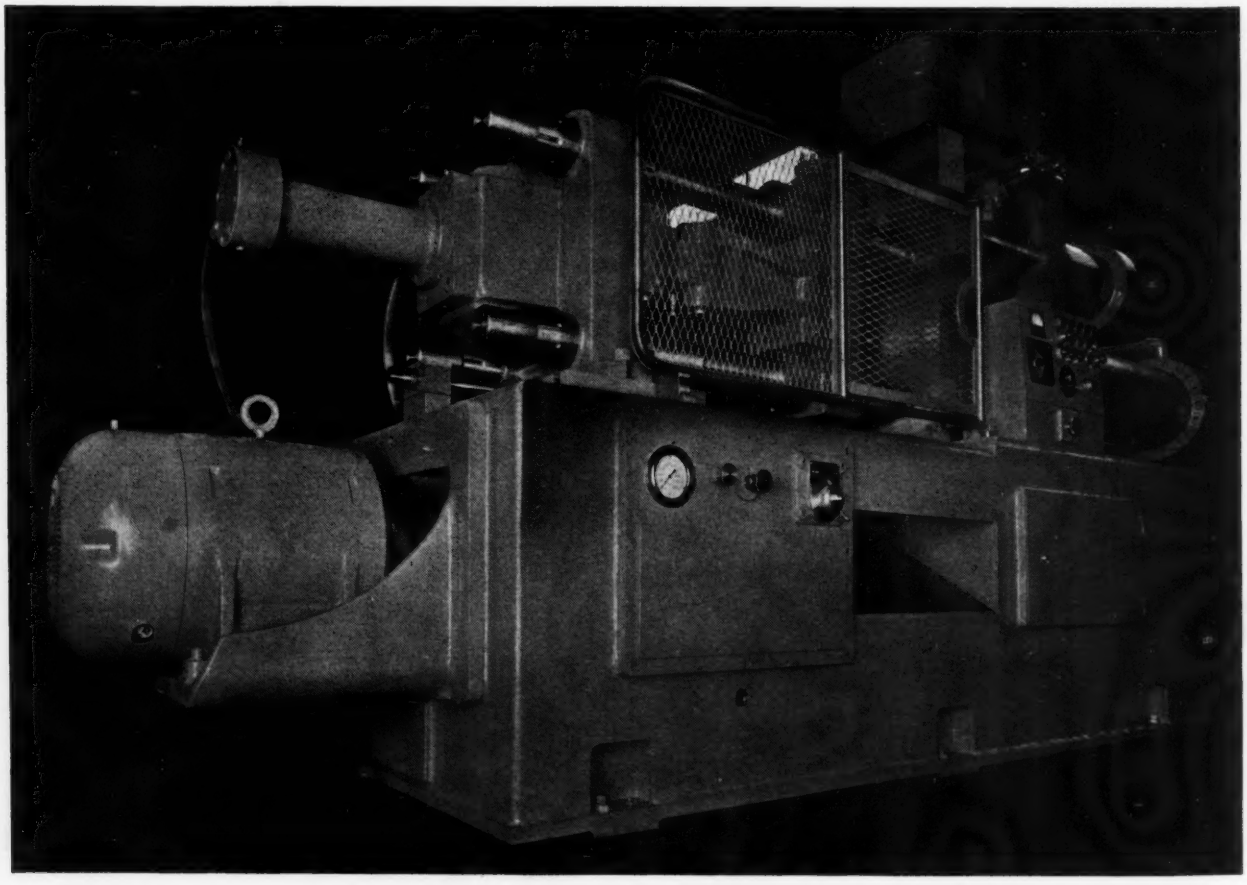


Fig. 1. "Hy-Jector" Automatic Molding Machine Used for Production of Thermosetting Plastic Parts

ing chamber at *E*. Incidentally, this view is made to a scale about three times as large as that used for the other views. In this chamber, the preform is heated to and maintained at a predetermined temperature for a specific period of time.

From the dielectric heating chamber the preform is transferred to the molding cylinder at *F*. The heating dies are held in the closed position by a power locking and clamping mechanism. As the preform is delivered to the molding cylinder, the charging ram advances rapidly under accurate control, forcing the preform into the die.

The material is forced into all the die cavities through gates, as indicated at *G*. Under automatic control, polymerizing takes place for the period of time established, after which the dies open and the finished part is ejected. Dimensional stability is claimed to be an inherent quality of the parts molded on this machine, their accuracy depending upon that of the dies.

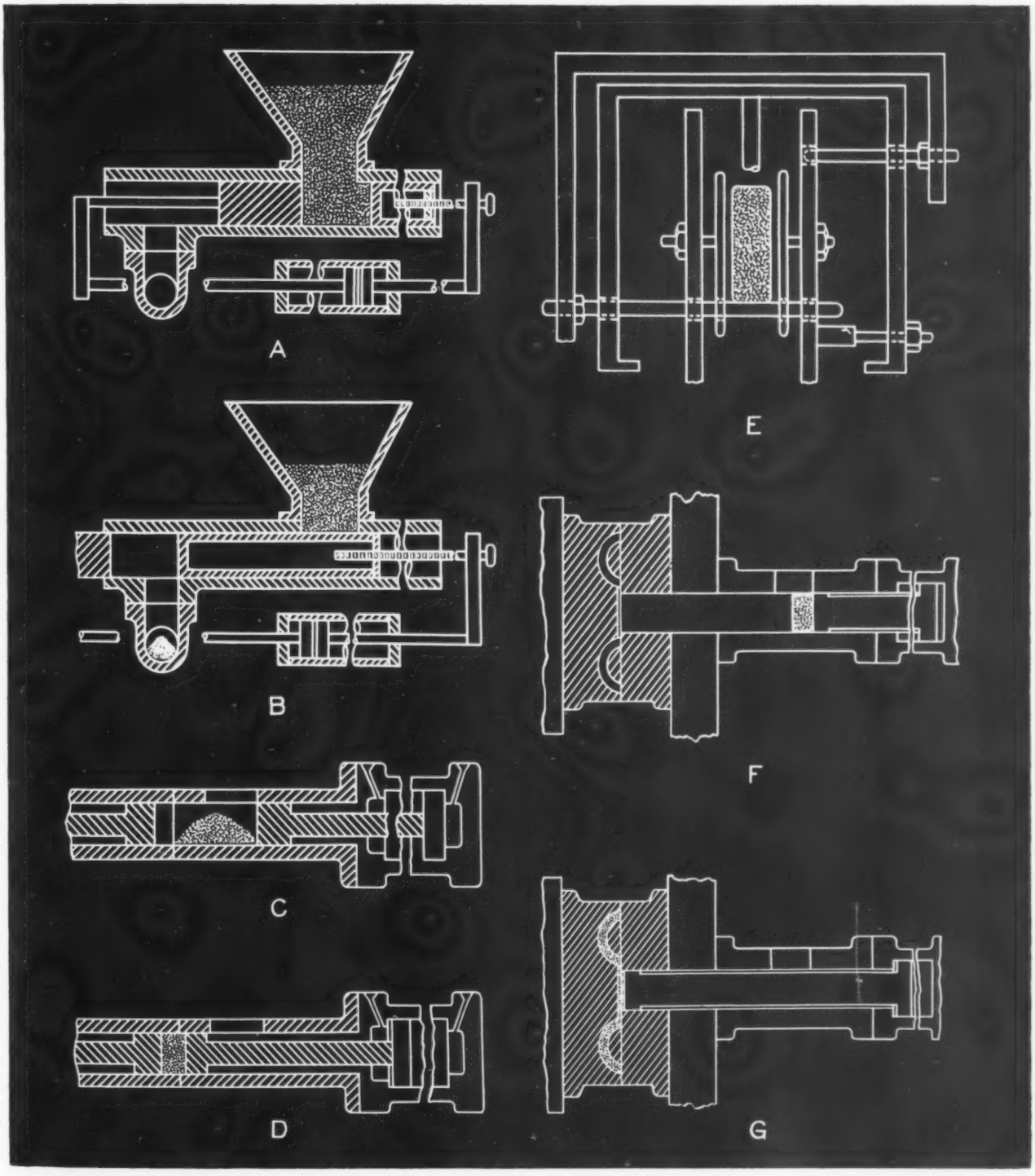


Fig. 2. Diagrams Illustrating Seven Steps in the Sequence of Molding Operations Performed Automatically by the Machine Shown in Fig. 1

Shop Equipment News

Machine Tools, Unit Mechanisms, Machine Parts, and Material-Handling Appliances Recently Placed on the Market

Wickes High-Speed Automatic Die-Casting Machine

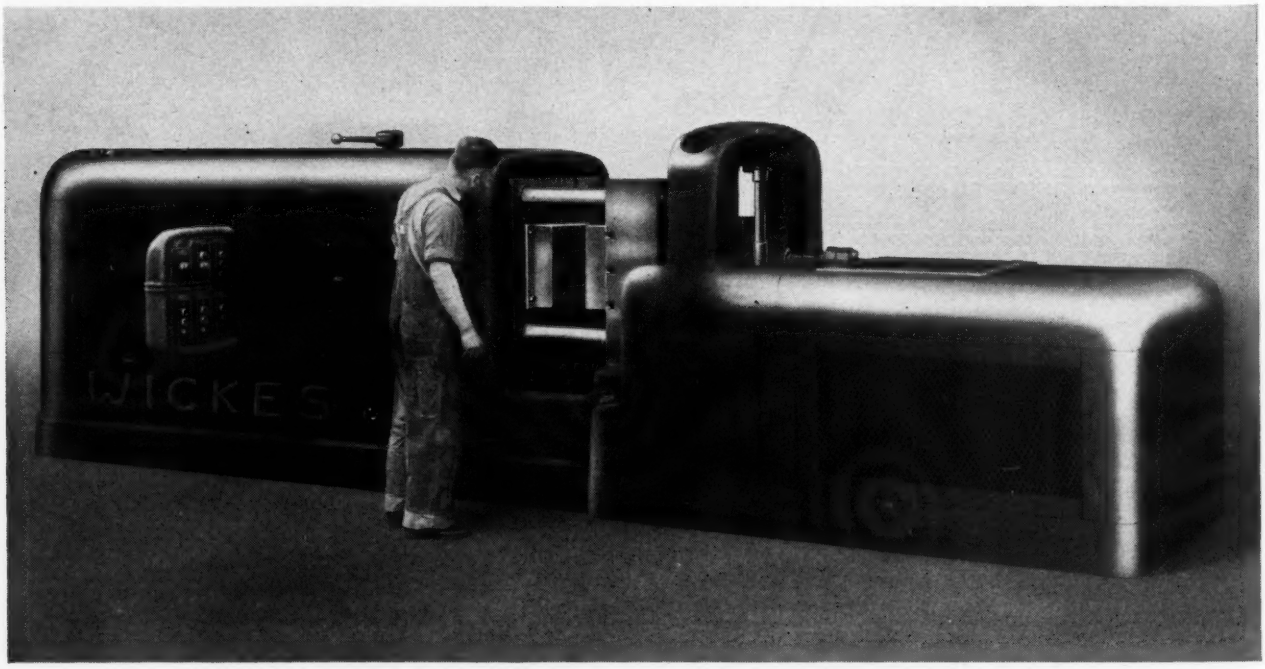
An automatic die-casting machine designed for the high-speed production of zinc, tin, and lead die-castings has just been announced by Wickes Brothers, Saginaw, Mich. When this machine is set up and supplied with die-casting metal, the simple pressing of an electrical starting button will cause it to automatically produce die-castings without further manual actuation of the controls. The high production rate has been made possible by providing for opening and closing the dies at a speed of 750 inches per minute, with a momentary slow-down just before the dies reach the final closed position. Provision is made for manual operation of any single function of the die-casting cycle, and the machine is designed to reduce set-up time to a minimum.

The distance between the platen and bolster plate is easily adjustable from 9 to 23 inches by either a hand- or a power-operated mechanism. The maximum daylight opening between the bolster plate and platen is 39 inches. The hydraulically actuated casting knockout is operated automatically under normal conditions, but it can be operated manually if desired.

Injection pressures of 1500 to 6000 pounds per square inch are obtained by a heavy-duty accumulator, which supplies hammer-blow pressure to twin injection cylinders. The opening of the dies can be adjusted from 6 to 16 inches by positioning a cam in the trip mechanism. The timing of the slow-down of the die-closing movement and that of the knockout are also easily adjustable.

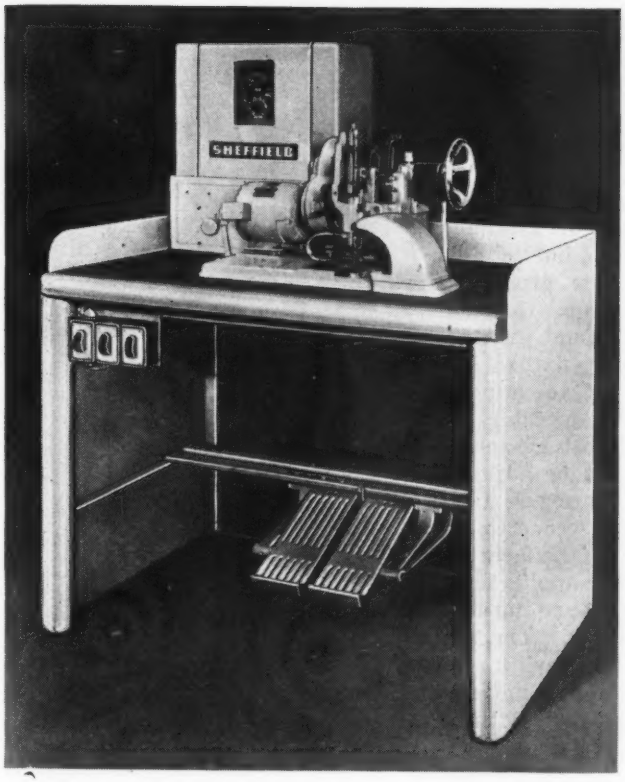
The machine is equipped with dual melting pots, the metal being melted in one pot and injected from the other. The melting pots have a capacity of 2200 pounds of zinc, and are equipped to maintain the molten metal at the required temperature within 4 degrees F. The gooseneck injection unit mounted in the high-heat pot has a submerged charging hole, so that only clear metal can gain access to the injection chamber. Heat is supplied by six infra red burners developed by the Burdette Engineering Co. These burners can be easily removed and are designed to facilitate inspection.

The machine has an injection capacity of 25 to 100 cubic inches per cycle, and will inject from 6 to 25 pounds of zinc per shot. The maximum operating speed is 600 shots per hour, and the maximum size of die accommodated is 24 by 37 inches. A 15-H.P. motor drives the hydraulic pumps. The die-casting machine occupies a floor space of 21 feet 6 inches by 6 feet 6 inches, is 6 feet 4 inches high, and weighs 35,000 pounds. 61



High-speed Automatic Die-casting Machine Brought out by Wickes Brothers

To obtain additional information on equipment described on this page, see lower part of page 240.



Sheffield Automatic Welding Machine for Assembling Contact Points on Springs

Automatic Hopper-fed Roll Gaging and Selecting Machine Made by the Sheffield Corporation

Sheffield Automatic Machine for Welding Electrical Contact Points

The Sheffield Corporation, Dayton 1, Ohio, is placing on the market an automatic machine for welding electrical contact material in the form of points or disks to contact springs. This machine, originally developed by the Western Electric Co., has been redesigned and improved by the Sheffield Corporation under a license arrangement, and is now being built for the Western Electric Co. and for other industrial users.

Accurate positioning and secure welding of the electrical contact material to the contact springs can be accomplished at a high production rate by this machine. The spring is loaded in a suitable holding fixture and moves through a series of stages. In the case of the disk type contact, the work performed by the machine consists of punching the disks and placing them at the proper positions on the spring, welding the contact and the spring together securely, and then shaping the contact to the required flatness or contour.

This machine has a capacity of 83 cycles per minute, and production within this capacity is limited only by the operator's ability to load the springs in the holding fixture. Actual production varies from about 1200 to 2400 contacts per hour. The welding current is controlled by an electrically operated panel, and when the correct number of ampere seconds has been determined for a particular size and shape of contact, automatic control of the current is applied so that all welds will be exactly alike. 62

Sheffield Automatic Hopper-Fed Roll Gaging and Selecting Machine

An automatic hopper-fed roll gaging machine designed for inspection of the length and diameter of small precision parts, such as roller bearings, dowel-pins, chain links, and similar products, has been brought out by the Sheffield Corporation, Dayton 1, Ohio. This machine can be adjusted to permit an infinite number of different sizes of parts within its capacity to be gaged quickly, economically, and to a tolerance of 0.0005 inch. It will gage parts ranging from 7/32 to 31/32 inch in diameter and from 9/32 inch to 3 inches in length. It can be readily changed from one set-up to another.

After setting up the automatic roll selector, using minimum and maximum masters or two parts known to be of the correct size, the parts to be gaged are placed in the hopper. All of the hopper or feed rails that come in contact with the parts are made of material selected to prevent the work from becoming clogged or congested due to residual magnetism. A reciprocating device serves to pick up the units, and by means of a gravity fed slide, conduct them to the gaging position. One Electrichek gaging head checks the over-all length, while two other gaging heads check the diameters at each end.

During the gaging operation, each part is classified and segregated into one of four groups. The first group contains parts within tolerance limits; the second, parts in which the diameter is within tolerance limits but the length is over size; the third, parts that are over size on the diameter; and the fourth, parts that are under size on either or both diameter and length. Chutes

To obtain additional information on equipment described on this page, see lower part of page 240.

are used to pass the segregated parts into separate bins. The automatic roll selector illustrated operates at a fixed speed to check and segregate 3600 parts an hour into the four classifications while gaging the three dimensions simultaneously. 63

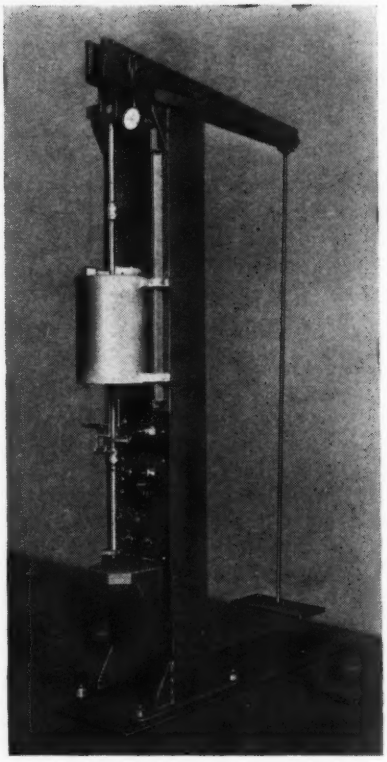
Air-Hydraulics Timing Device

Air Hydraulics, Inc., 401 E. Broadway, New York 13, N. Y., has developed a timing device for use on the company's line of air-hydraulic presses. The device is designed to automatically control the reversal of the ram at a predetermined pressure, so that on each ram stroke cycle the full predetermined pressure will be delivered before reversal takes place. Without this timing device, it is necessary for the operator to hold down the button until the down stroke is completed.

Two push-buttons provide a positive safety feature, since they require the operator to employ both hands to start the ram cycle.

The air-hydraulic press and timing device, in conjunction with an indexing unit, can be set for completely automatic multiple cycling for all types of assembly, forming, marking, and similar operations on volume production work. For such set-ups, the operator simply has to mount the work units on the indexing fixture. The timing device is set to suit the speed at which the operator can feed the machine most efficiently.

The ram dwell can be adjusted for any desired interval from fractional parts of a second to two minutes. This is particularly advantageous in plastic applications, where heat and pressure must be applied simultaneously. The air-hydraulic press used with the timing device assures a uniform pressure squeezing action without impact shock in performing assembly operations on fragile material. 64



Baldwin Creep-testing Machine Equipped with Heating Furnace

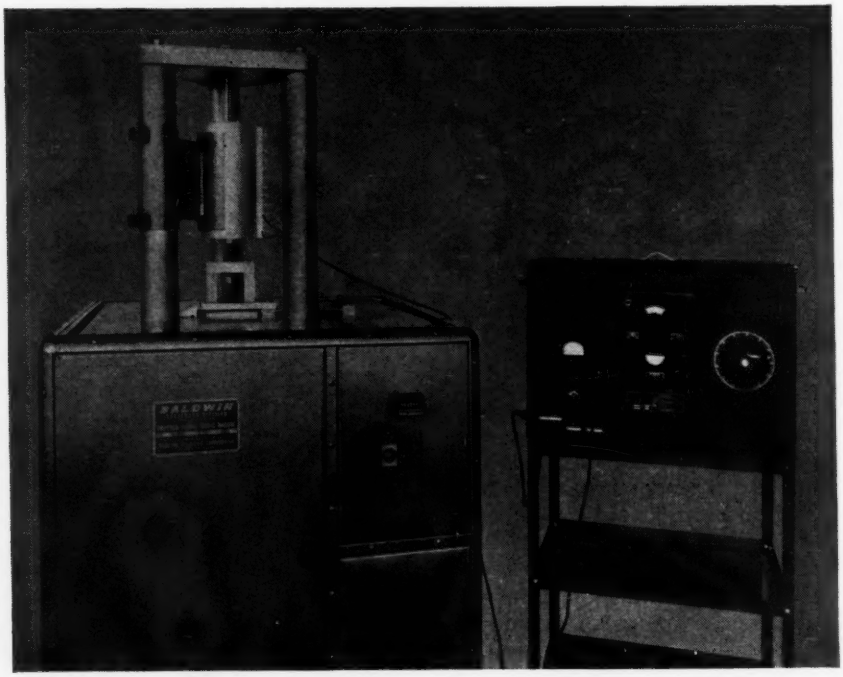
Baldwin Creep-Testing and Fatigue-Testing Machines

The Testing Equipment Division of the Baldwin Locomotive Works, Philadelphia 42, Pa., has made available a creep-testing machine that can be supplied for use in research laboratories for testing metals at elevated temperatures to determine the creep rate. The machine is of the lever-arm type, and is of welded steel construction. It has a capacity of 12,000 pounds (60,000 pounds per square inch on a 0.505-inch diameter specimen) and has a guaranteed accuracy of within 1 per cent of the load.

Strain indication is obtainable by an extensometer attached in pin-holes at shoulders of the specimen and is read directly to 0.000025 inch on a motor-driven revolution counter by means of a follow-up contact method. This strain unit is accurate to within approximately 0.00005 inch. In operation, the specimen is heated by a small furnace having coils wound with chromel wire. Maximum temperature of the furnace supplied as standard equipment is 1600 degrees F., but furnaces for temperatures of 1800 and 2200 degrees F. can be provided if desired. The maximum possible elongation of the specimen is 1 3/4 inches.

Another machine announced by the Baldwin Testing Equipment Division is a new Sonntag fatigue-testing machine, equipped for tension-compression testing both at ambient and at high temperatures. This machine embodies many of the principles of the Sonntag universal fatigue-testing machine, particularly the automatic maintenance of a constant load through the whole period of the test.

The maximum capacity of the



Baldwin Sonntag Fatigue-testing Machine

To obtain additional information on equipment described on this page, see lower part of page 230.

new machine in either direction is 10,000 pounds; static preload capacity, 0 to 5000 pounds; alternating (dynamic) load capacity, plus or minus 5000 pounds; speed of testing, 3600 load cycles per minute; and maximum movement of reciprocating platen, plus or minus 1/16 inch. The machine weighs 3000 pounds. 65

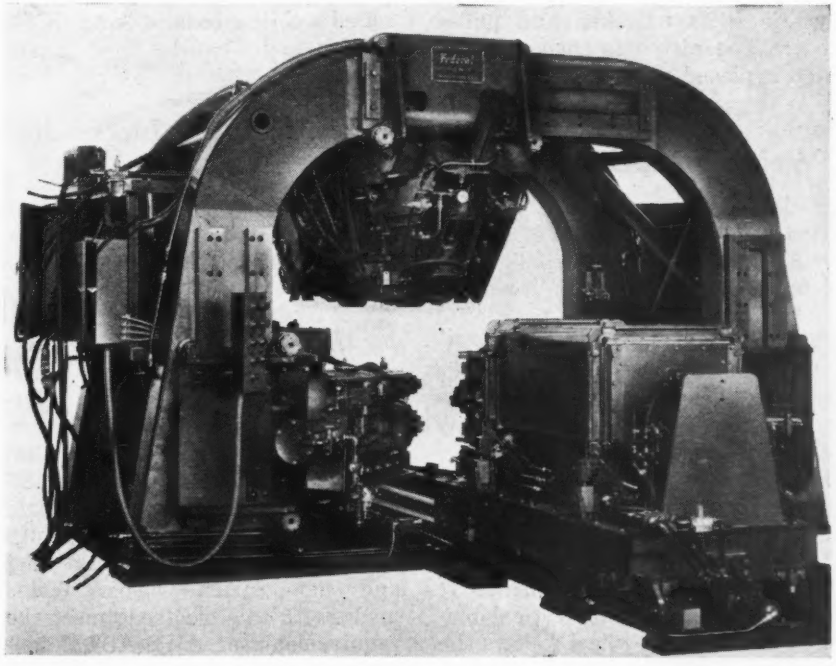
Federal High-Production Seam Welder

A new traveling-head mash seam welder known as the "Triple Duplex" has been developed by the Federal Machine & Welder Co., Warren, Ohio, and is being used by the Seeger Refrigerator Co., St. Paul, Minn., for welding food-compartment liners for four sizes of refrigerators having capacities ranging from 7 to 11 cubic feet.

This machine has three 300-KVA water-cooled transformers wound for 440-volt, 60-cycle, single-phase alternating-current power supply, with individual sixteen-step heat regulators. One welding transformer is mounted in each of the three dual welding heads, and the welding wheel-spindles are internally water-cooled. The heads are angularly mounted to facilitate welding liners which are positioned at a 45-degree angle. They are manually adjustable both vertically and laterally to accommodate liners of various sizes. Adjustments in the lengths of travel of the welding heads are accomplished by simply changing limit switch settings.

The equipment has its own hydraulic system, with hydraulic pump unit and oil cooling reservoir for supplying hydraulic fluid under pressure to the welding-head traversing cylinders and fixture-carriage actuating cylinder. Each of the six heads is provided with its individual air cylinder for applying welding pressure.

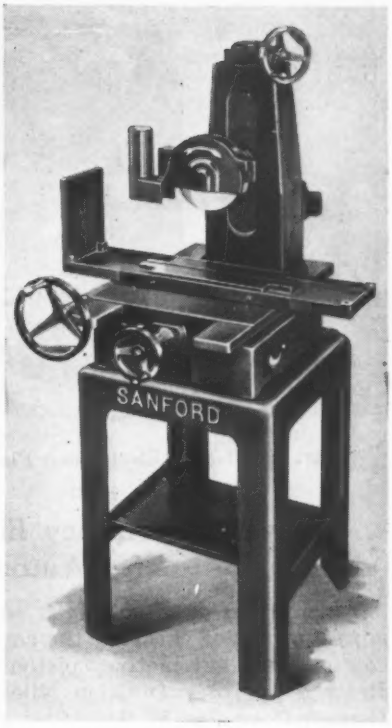
The 20-gage steel food-compartment liners welded on the machine illustrated are composed of three parts—the wrapper, which forms the two sides and the back of the liner; and the top and bottom, which are welded to the ends of the wrapper. The complete welding cycle requires 25 1/2 seconds, giving a production rate of about 90 units per hour, with one operator and one helper. 66



Federal Seam Welder Equipped for Welding Food-compartment Liners for Refrigerators

Sanford Surface Grinder

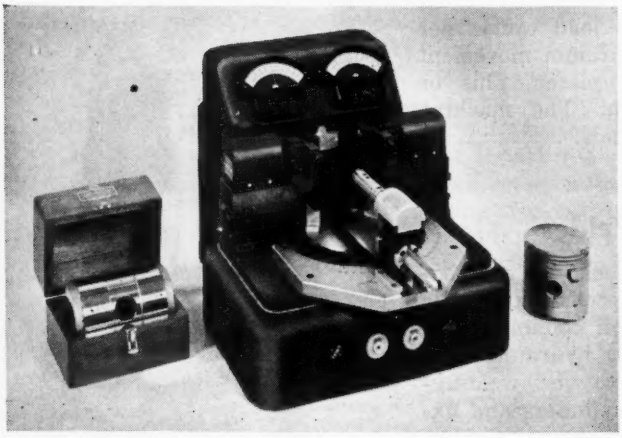
A surface grinder designed to meet the need for a small high-speed, precision machine for grinding small tools, cutters, dies, gages, instrument parts, and similar work, has been brought out by the Sanford Mfg. Co., 1020-28 Commerce Ave., Union, N. J. The sensitivity and ease of control necessary for such operations on parts that can be easily held in the palm of the hand, for example, have been incorporated in the new machine. This machine serves to release larger grinders for use on work for which they are better adapted.



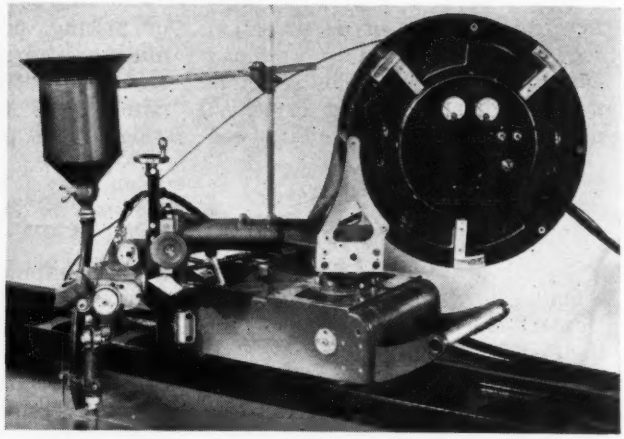
Sanford Surface Grinder Designed for Small Precision Work

The Sanford surface grinder is designed especially for handling small jobs which must be held to size within 0.0001 inch. The magnetic chuck has a work-holding surface of 3 by 5 inches, and the table has a work surface of 5 5/8 by 12 1/4 inches. The table has a longitudinal travel of 8 inches and a transverse travel of 4 inches. The vertical movement of the wheel-head is 6 inches, and the maximum distance between the magnetic chuck and a 4-inch wheel is 4 inches. The grinding wheel dimensions are 4 inches by 3/8 inch by 1/2 inch. The spindle has a speed of approximately 5500 R.P.M., and is driven by a dynamically balanced 1/6-H.P., 110-volt alternating-current, 60-cycle motor having a speed of 3450 R.P.M. The net weight of the machine is approximately 160 pounds. 67

To obtain additional information on equipment described on this page, see lower part of page 240.



Pratt & Whitney Electrolimit Piston Contour Gage



Unionmelt Automatic Portable Welding Machine

Pratt & Whitney Electrolimit Contour Gage for Automotive Pistons

In order to provide a fast, accurate means of checking the cam contour of automotive pistons, Pratt & Whitney Division Niles-Bement-Pond Co., W. Hartford 1, Conn., has developed an Electrolimit two-station contour gage.

This gage has a floating-pressure shoe arbor mounted on a slide in such a manner that the arbor can be pulled out to permit installing the piston for gaging. Easy, quick removal of the piston after it is measured is also accomplished by pulling out the arbor. The arbor assembly rotates through an arc of 180 degrees, and two Electrolimit heads are used to indicate the cam contour. Each head has been designed to incorporate a floating gaging point and a fixed pick-up point.

When the piston is mounted on the floating-pressure shoe arbor through the piston-pin hole with the piston skirt up, the arbor is pushed into position for gaging and locked in place. The fixed pick-up points contact the bottom piston-ring land, which is ground to a true circle. The floating gaging points rest on the bottom of the cylinder skirt. As the piston is rotated through 90 degrees either side of the center position, the meters indicate the variation in cam contour between the ring land and the skirt. When the variations of the cam contours have been observed, the slide is returned to the center position, where it is unlocked and pulled out. The piston is then removed and replaced with a new one.....68

Portable Unionmelt Welding Machine

A portable automatic machine built especially for welding light-gage sheet and light plate by the Unionmelt process (the process of welding electrically beneath a layer of granulated mineral composition without visible arc) has been developed by The Linde Air Products Company, Unit of Union Carbide and Carbon Corporation, 30 E. 42nd St., New York 17, N. Y. This machine is small and light, weighing only 190 pounds, and can be moved from one location to another as the work requires. The machine can be either placed directly on the work and guided by hand, mounted on a standard track, or guided by a small structural angle-iron, which is clamped to the work for production welding.

Extensions are available for lengthening the nozzle assembly in order to make non-positioned fillet welds or welds located below the level of the carriage. The welding head can be swung forward 45 degrees, tilted to any angle at either side, or positioned anywhere in a circle around the carriage. The head-supporting arm can be extended as much as 5 inches, and the head also has a vertical adjustment of 5 inches. It can be set to permit vertical motion as the guide wheel follows the surface of the work-piece. Small vertical and lateral adjustments for positioning the welding head can be easily made by means of handwheels. The welding head and rod reel are mounted on a high-speed carriage which has accurate, stepless speed control within a range of 7 to 210 inches per minute. The welding head without the carriage can be used for a stationary installation.

This machine will butt-weld, in a single pass, material from 16 gage to 3/4 inch thick. It will also make, in a single pass, positioned fillet welds with legs measuring 1/8 to 3/4 inch; non-positioned fillet welds with legs from 1/8 to 3/8 inch; and plug welds in material 1/4 to 1 1/4 inches thick. Material of any thickness can be welded by using multiple passes. Welding currents up to 1200 amperes can be applied, and coiled welding rods of 3/32 to 1/4 inch diameter can be used. 69

Westinghouse Electrodes

A new ACP-MO electrode, available in four diameters ranging from 3/32 to 3/16 inch, has been brought out by the Westinghouse Electric Corporation, P.O. Box 868, Pittsburgh 30, Pa., for welding low-alloy cast steel or low-alloy high tensile-strength rolled steels in all positions, with alternating current or with direct current, reverse polarity. This electrode is recommended for vertical or overhead welding, but is said to produce equally satisfactory results in making horizontal fillet and flat-position welds. Welds made with this electrode meet the requirements of AWS-ASTM tentative specifications for iron and steel arc-welding electrodes, Classification E-7011. 70

To obtain additional information on equipment described on this page, see lower part of page 240.

Brandes Automatic Presses

The Brandes Press Co., 6408 Euclid Ave., Cleveland, Ohio, has announced a complete line of automatic presses, including sizes covering a range of from 30 to 750 tons. The machines in this line are rigidly constructed, and have large bed areas designed to handle progressive die work. They can be equipped to perform blanking, forming, and drawing operations on a wide variety of parts at exceptionally high speeds.

These presses have a crankshaft located below the bed and arranged to work through a lower cross-head, and guided draw-rods that serve to pull the top platen down on the material evenly and with a uniform pressure applied at four points. They are equipped with an electrically controlled, air-operated friction disk clutch and brake. All moving parts are lubricated through a centralized system.

Other features include long multiple V-ways in the base for guiding the lower cross-head. All reciprocating parts are pneumatically counterbalanced. No special foundations are required, as there are no structural members or operating parts that extend below the base of the machine.

The press shown in the illustration has a capacity of 175 tons, and is equipped with a double roll feed and a scrap cutter. Back-geared machines are also available in all sizes for deep-drawing work. These machines have a special quick-feeding arrangement, so that a greater portion of the stroke can be utilized for drawing operations. 71

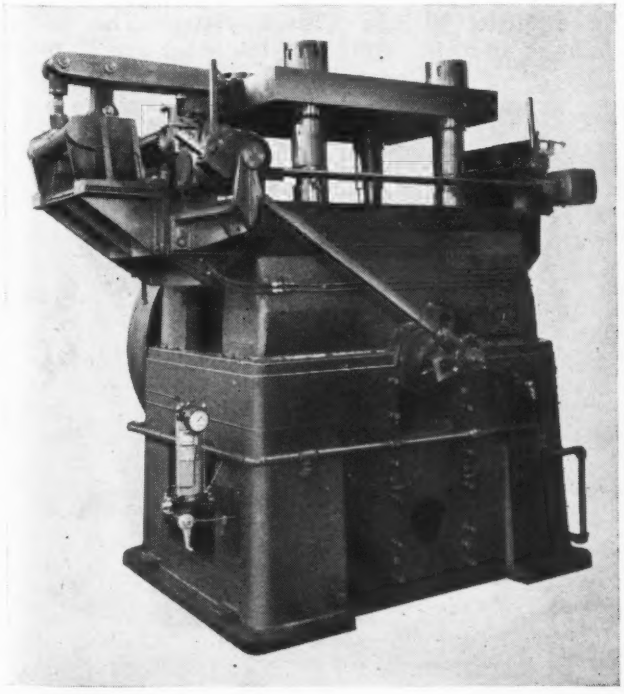
Machine for Heat-Treating Light-Weight Assemblies

The Selas Corporation of America, Philadelphia 34, Pa., has recently designed an automatic gas-fired machine to meet the demand for equipment capable of improving the heat-treatment of fragile assemblies which may weigh only a few ounces. The particular machine illustrated is equipped for the heat-treatment of magnetic pull-wires used in business machines. The closely controlled heat provided by the new machine is said to produce superior results at a high production rate. The pull-wire assemblies consist of two eyelets, welded to a connecting high-carbon steel wire. The machine hardens the eyelets to obtain greater wear resistance, and at the same time, anneals the weldments to prevent breakage.

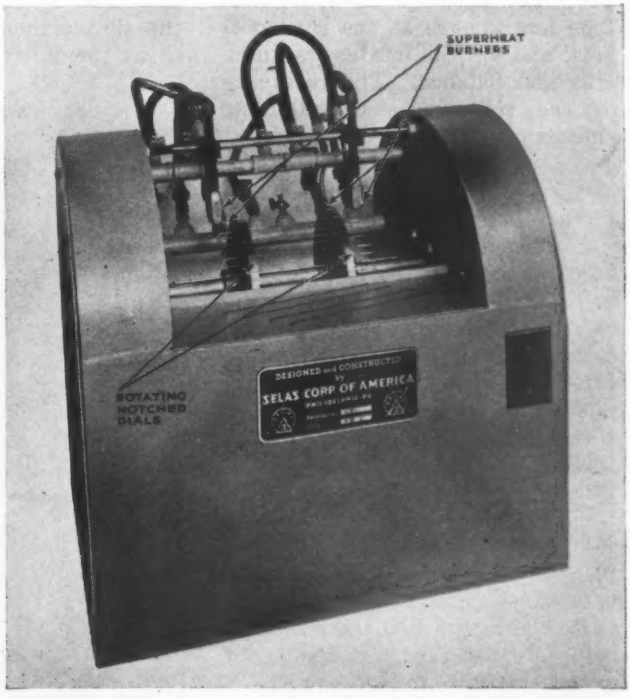
The assemblies are placed on the rotating drum of the machine. The eyelets are heated to a hardening temperature by a set of staggered high-heat burners, and are quenched by a water spray attached to the side of the burners. The second set of burners serves to anneal the weld while cooling water is applied to the hardened eyelets to prevent them from being annealed. The production rate of this machine is about 1200 pieces per hour. 72

Penetone Cutting Fluid

A fluid developed to combine the three essential requirements of a cutting lubricant—namely cooling, cleaning, and non-toxic qualities—is announced by the Penetone Co., Department 12, Tenafly, N. J. This liquid emulsifier is said to eliminate the necessity for cleaning cutting oils off parts after they have been machined, since the cutting fluid actually cleans the metal as it lubricates and cools. It contains no solvents, abrasives, or free alkali, and does not harm the hands. 73

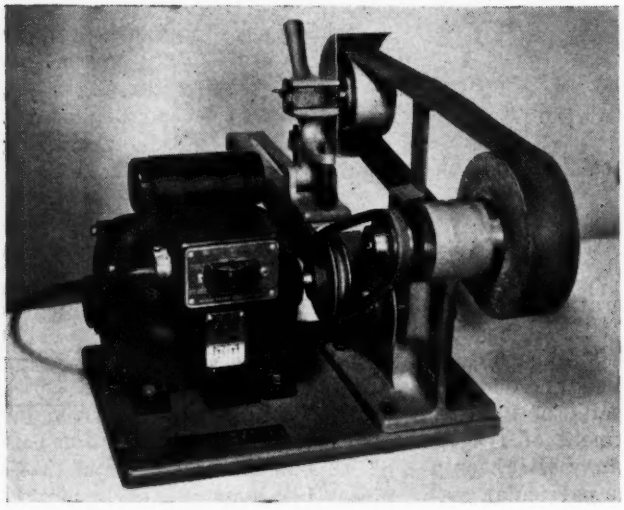


Brandes High-speed Automatic Progressive Blanking, Forming, and Drawing Press



Selas Automatic Gas-fired Heat-treating Machine for Small Assembled Parts

To obtain additional information on equipment described on this page, see lower part of page 240.



Abrasive-belt Grinder Developed by the Porter-Cable Machine Co.

Hydraulic Clamping Unit Built by the John S. Barnes Corporation

Abrasive-Belt Grinder

The Porter-Cable Machine Co., 1801-5 N. Salina St., Syracuse 8, N. Y., has developed an abrasive-belt unit which can be employed as a utility grinder in the manner shown in the illustration. This arrangement permits grinding to be done on the arbrasive belt while it is operating over a resilient contact roll or wheel, as well as over a flat surface or support like the one shown in the illustration. Since the wear is on the abrasive belt, and not on the supporting contact wheel or flat support, the wheel or roll remains true and square at the corner or side, and also maintains its diameter and balance. The resiliency of the roll serves to eliminate chatter, and it is claimed that even an inexperienced operator can grind work to a smooth surface on the balanced roll.

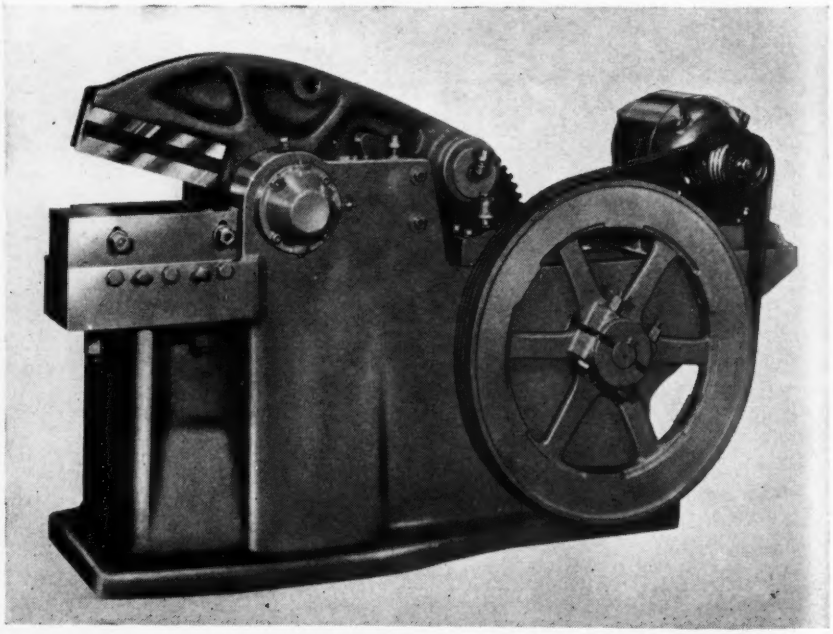
Grinding on or over the roll quickly reduces the size of the work, so that it can be squared up on the platen provided immediately above the roll. Grinding internal surfaces can be accomplished by employing the platen. Rounded or oval parts, such as scissor handles, can be ground and polished by employing an additional formed resilient contact roll, attached to the grinder in place of the platen. Work can also be ground on the free or unsupported abrasive belt, this method being especially adapted for grinding contours, following a pattern, or grinding in otherwise inaccessible places, as in grinding fork tines. 74

John S. Barnes Hydraulic Clamping Unit

A small, self-contained hydraulic clamping unit, designed for greater economy and efficiency in chucking and clamping operations, has been placed on the market by the John S. Barnes Corporation, 301 S. Water St., Rockford, Ill. This rapid-action unit can be adjusted for any desired pressure up to 500 pounds per square inch and can be equipped with a 1/4- to 1/2-H.P. motor. It is suitable for actuating lathe chucks, clamping cylinders for fixtures, and any other applications requiring a large volume of fluid to be delivered at very short intervals and maintained at high pressure.....75

Canton Alligator Shear

The Canton Division of the Hill Acme Co., 6400 Breakwater Ave., Cleveland 2, Ohio, has announced the development of a Model 00 shear for cutting light scrap metals. This new shear has a capacity for cutting 1 1/2-inch round or square mild steel bars and 3/8-by 12-inch plates. The cutting knives of the shear are 12 inches



Canton Alligator Shear Designed for Cutting Light Scrap Metals

To obtain additional information on equipment described on this page, see lower part of page 240.

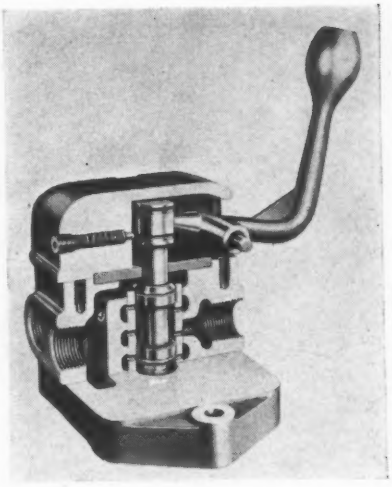
long. The adjustable knife seat is so designed that it requires no shimming after the knives have been reground. The king-pin, crankshaft, and countershaft are equipped with bronze bushings...76

Moore Locating Microscope

A locating microscope that shows the image in the natural instead of in the inverted position has been developed by the Moore Special Tool Co., Inc., 734 Union Ave., Bridgeport 7, Conn. This new instrument is designed to easily locate edges, contours, irregular shapes, and holes that are too small to be located by the usual methods. With the work shown in the natural position, table settings can be made without the confusion caused by the necessity for transposing reversed or inverted table movements, as in the case of conventional locating type microscopes.

In addition to a double pair of cross-lines, spaced 0.001 inch apart, the reticule contains a large number of conveniently spaced concentric circles whose lines are broken to facilitate locating small or large radii that would otherwise be covered by the line. The microscope has a magnification of 40X, which enables work to be located to an accuracy of 0.0001 inch and yet does not unduly reduce the field of vision.

The instrument is designed for use in the Moore jig borer or jig grinder. It serves to increase the usefulness of these machines by converting them into inspection equipment for precision checking operations. Locational accuracy can be quickly determined by substituting the microscope for the cutting tools or grinding heads. Work can thus be checked without disturbing the set-up in the machine. With a suitable shank or adapter, this locating microscope can be attached to any machine or inspection tool. 77



Cutaway View of Logan Vertical Piston Type Valve

Logan Improved Air Control Valves

The Logansport Machine Co., Inc., 905 Center Ave., Logansport, Ind., has completely redesigned its line of air control valves. Seventy-nine improved standard models are now available. The new four-way air valves are now offered in a wide range of types for all kinds of air-operated equipment employing pressures up to 150 pounds per square inch.

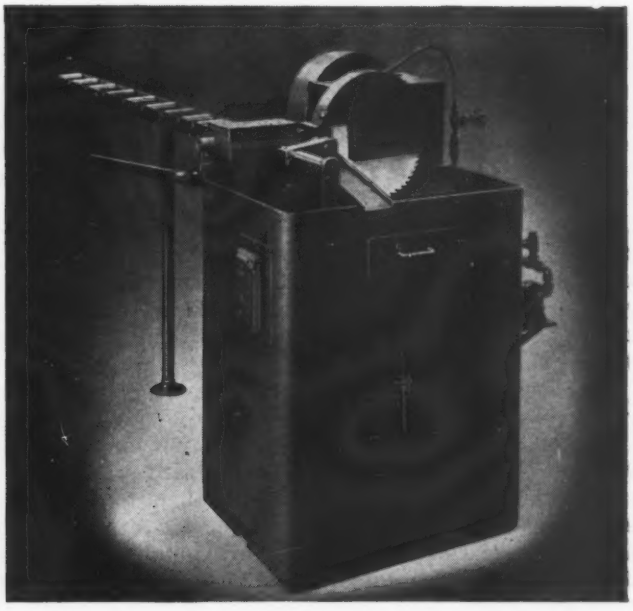
The new line includes direct-operated valves with various operating characteristics, including manually-, toggle-, foot-, and cam-actuated models. A light-duty type of compact design is also available.

Remote-operated types are furnished for direct electric solenoid actuation by push-buttons; in bleeder types, actuated by remote two-way bleeder valves; and in pilot pressure-operated types. The balanced piston type design of these valves provides for effortless operation. 78

Cochrane-Bly Metal-Sawing Machine

A new metal-sawing machine has been announced by the Cochrane-Bly Co., 9 St. James St., Rochester 6, N. Y. The new saw is No. 22 in a complete series of saws developed by this company

Locating Microscope Developed by Moore Special Tool Co.



Metal-sawing Machine Made by the Cochrane-Bly Co.

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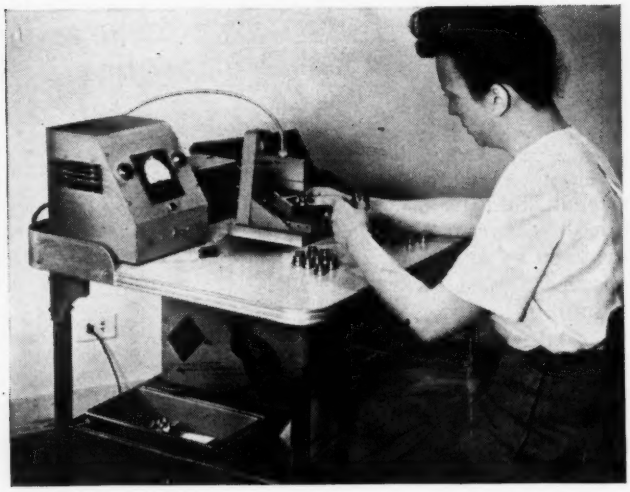
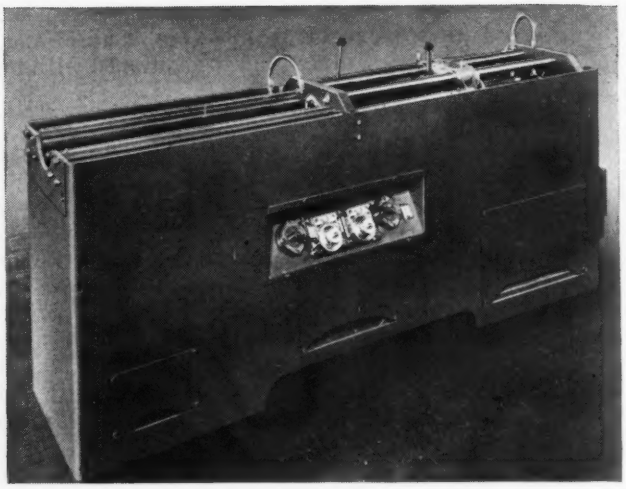


DoAll Automatic Precision Inspection Machine



Zagar Double-cylinder Hydraulic Broaching Machine

for ferrous and non-ferrous metals and plastics. It is designed to meet the requirements for a low-cost saw with high operating efficiency on stock up to 2 inches in diameter. Rigid precision construction is said to make this machine practically vibrationless, with the result that clean, smooth, burrless cuts are obtained, which seldom require milling or finishing. This saw is available in automatic, semi-automatic, and hand-operated models. 79

DoAll Automatic Precision Segregating Inspection Machine

The DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill., has brought out a new machine designed to make possible low cost 100 per cent automatic inspection of small parts. This new machine, or selector, is essentially an electronic segregator, which automatically sorts small parts into three classifications designated over size, acceptable, and under size. It is accurate to 0.000010 inch, and will sort parts with tolerances from plus or minus 0.0001 to plus or minus 0.005 inch at speeds up to 12,000 parts per hour.

The selector consists basically of three units—the gaging head, the master control, and the segregator. The unique electrical circuit makes possible operation at any speed, limited only by the rate at which parts can be fed to the machine. Fully automatic and semi-automatic feed mechanisms are available.

In addition to having red and green indicating lights, the master control unit has a graduated indicating dial gage which provides visible readings showing the size of each part as it is being sorted. The gage is electronically operated, and is hermetically sealed to protect it from dust and moisture. An electrical counter can be provided for counting the number of acceptable and of over-size pieces. A hearing aid can also be supplied which makes possible efficient operation of the selector by a blind person. 80

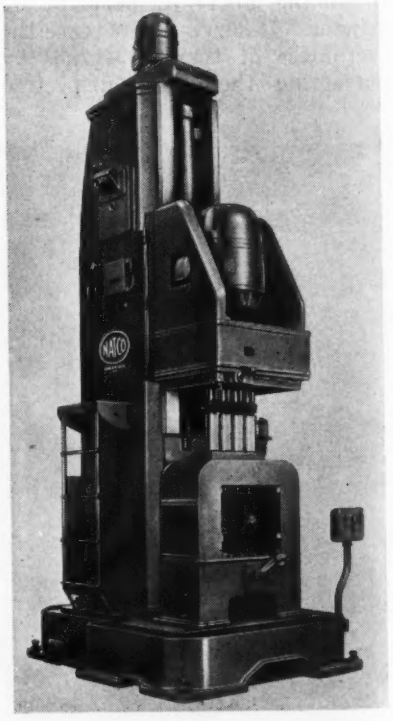
Natco Vertical Cylinder-Boring Machine

A new "Holesteel" vertical machine designed for boring cylinders for replaceable sleeve liners has been brought out by the National Automatic Tool Co., Inc., Department 40, Richmond, Ind. This Natco machine is arranged with hydraulic feed and has a fixed-center, gear-driven head containing four spindles. The part machined in this application is a cylinder and crankcase of cast iron, the production rate being twenty-eight parts per hour.

The machine is arranged to perform a combination operation of rough- and finish-boring four cylinder bores to a diameter of 3.781 inches and counterboring them to a diameter of 4.001 inches. A jump feed is utilized for rough- and finish-boring the lower holes to a diameter of 3.719 inches and machining a 1/4-inch 15-degree chamfer. 81

Zagar Broaching Machine

A double-cylinder 36-inch stroke hydraulic broaching machine which is designed to permit setting up two jobs at one time, has been brought out by Zagar Tool, Inc., 23880 Lakeland Blvd., Cleveland 17, Ohio. With this equipment, either end of the machine can be operated while work is being set up at the other end. Extremely slow ram speeds without a reduction of pulling power are made possible on this machine by an oil control valve.



Natco Vertical Cylinder-boring Machine

To obtain additional information on equipment described on this page, see lower part of page 240.

A fast return stroke is provided, and a pulling power of 16,000 pounds is available on the working strokes. Hair-line selection of speeds is obtainable by controls conveniently grouped on the recessed instrument panel.

The new machine, while designed to save floor space, leaves adequate room for the operator, without chip interference or oil splashing. A Cuno oil filter is employed to prevent valve clogging. This machine is equipped with a 220- to 440-volt, three-phase, 60-cycle motor wired to suit the available current. 82

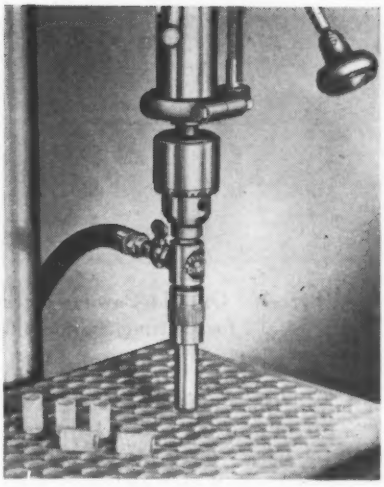
Fry Multi-Duty Tool-Holder

The Airo Products Co., 2709 W. 54th St., Los Angeles 43, Calif., has announced the Fry multi-duty tool-holder, which has been developed to facilitate drilling, reaming, tapping, boring, turning, facing, recessing, forming, threading, knurling, and cutting-off operations on a lathe in one chucking without the use of a tailstock. The large solid steel base and the hardened and ground working and locating parts are designed to assure long life and accurate performance, as well as to save time on lathe operations. It is made in sizes to fit lathes from bench models up to heavy-duty types. 83

Felker "Di-Met" Diamond-Abrasive Core-Drill

A diamond-abrasive core-drill known as the "Di-Met," designed to drill holes of any depth in hard, brittle, non-metallic materials, such as glass, tile, concrete, porcelain, ceramics, gems, etc., has been brought out by the Felker Mfg. Co., Torrance, Calif. The new core-drill is said to have exceptional speed, due to the novel method of supplying coolant through the drill stem to the special metal-bonded diamond abrasive rim. The coolant pressure serves to flush the chips and sludge from the kerf as fast as they are developed, and since the coolant supply is constant, the drill functions without developing appreciable heat, regardless of the depth to which the hole is drilled.

This core-drill can be used in drill presses, on portable electric drills, or it can be directly coupled to motor shafts. It operates in any position, and requires only a few seconds per inch of travel when drilling most materials.

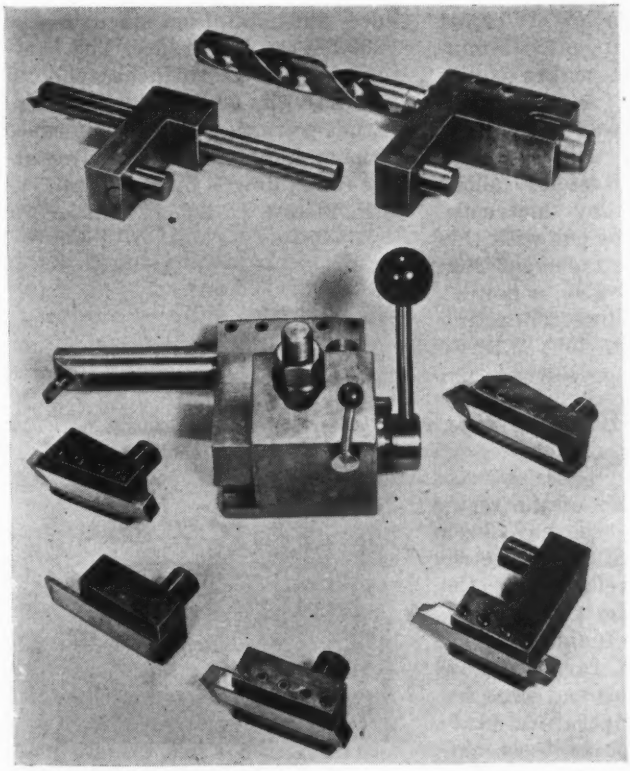


"Di-Met" Diamond-abrasive Core-drill

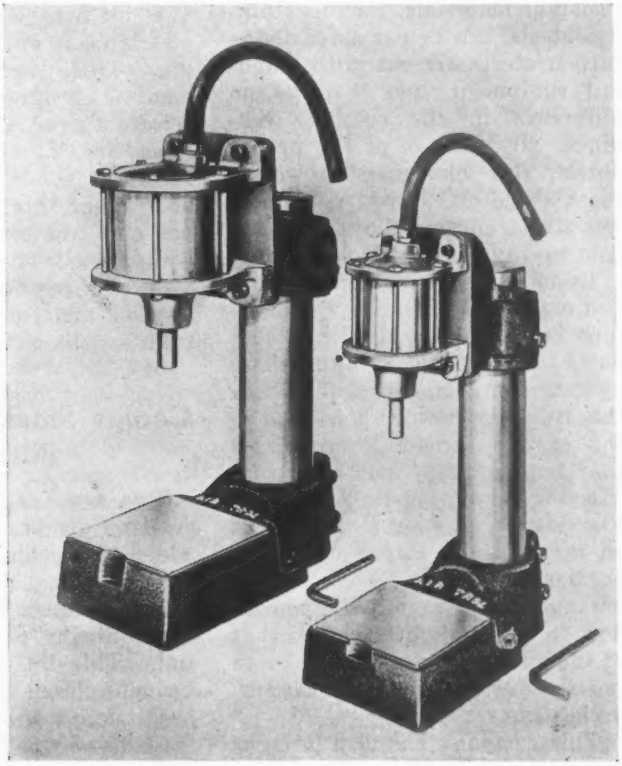
Only three drill heads are required for drilling holes from 1/8 inch to 2 1/2 inches in diameter. Standard drill lengths are 2 5/8 inches, but drills of any length can be supplied. 84

Air-Trol Air-Operated Arbor Presses

To supplement its line of fast-acting, spring-return air cylinders for material-holding operations, Air-Trol, 2653 W. Lake St., Chi-



Fry Multi-duty Tool-holder for Lathes



Air-operated Arbor Presses Brought out by Air-Trol

To obtain additional information on equipment described on this page, see lower part of page 240.

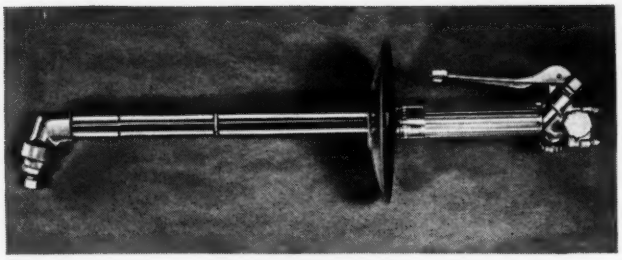


Fig. 1. Oxweld Powder-cutting Blowpipe for Cutting Stainless Steel

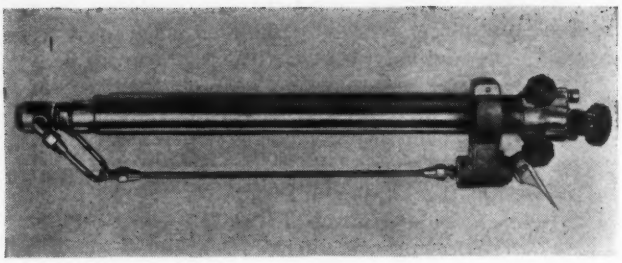


Fig. 2. Powder-cutting Attachment for Use with Standard Blowpipe

cago 12, Ill., is introducing two new air-operated arbor presses. One is a heavy-duty model weighing 72 pounds, which delivers well over a 3/4-ton squeeze at an air-line pressure of 150 pounds. The smaller model weighs 40 pounds, and delivers approximately 1/4 ton pressure at the same air-line pressure.

These units, when applied to arbor or kick-type press operations, can be set by regulating the air-line pressure to give uniform pressure on each application, assuring just enough effort to do the job without danger of crushing. The cylinder brackets are adjustable on the columns to give a working range, or ram clearance, of 0 to 6 inches over the table. 85

Powder-Cutting Blowpipe and Equipment for Cutting Stainless Steel

A hand-operated cutting blowpipe for use with the powder-cutting process has been developed by The Linde Air Products Company, Unit of Union Carbide and Carbon Corporation, 30 E. 42nd St., New York 17, N. Y. With this blowpipe (Fig. 1) oxidation-resistant materials, such as stainless steels, can be cut as easily as carbon steels are cut with standard equipment, and there is no difference in the cutting technique. By the use of the proper nozzle, this blowpipe, known as the Oxweld AC-4, will cut stainless steels, chrome alloys, and cast iron up to 9 inches thick.

In addition to the usual oxygen and oxy-acetylene hoses, the blowpipe has a third hose which conducts the powder from a dispenser by means of compressed air. When this iron-rich powder is burned in the oxygen stream, it increases the temperature and oxidizing effect of the oxygen-cutting action. The same valve lever that turns on the cutting oxygen starts the powder flow. The valves are so arranged as to permit the powder flow to begin slightly before that of the cutting oxygen, in order to insure starting the cut without preheating.

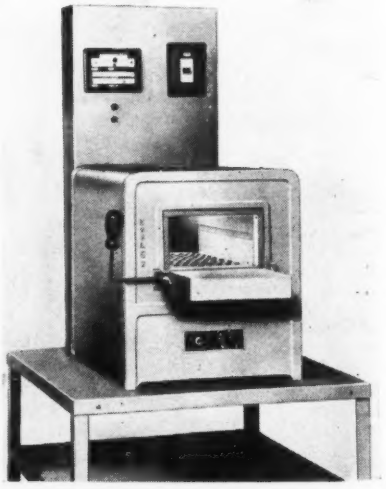
This company has also brought out a powder-cutting attachment (Fig. 2) which permits using standard equipment for cutting stainless steel. This powder-cutting attachment is designed for the standard Oxweld C-39 machine-cutting blowpipe. With appropriate sizes of standard nozzles, it will cut all the common types of stainless steels ranging from 1/4 inch to 3 inches thick at speeds of 20 to 7 inches per minute. This powder-cutting equipment is designed for cutting intricate shapes, as well as straight lines and bevels. All types of stainless steels, Hasteloy alloys and other high-alloy materials, and cast iron can be cut with this equipment. The attachment consists of a powder valve, a powder nozzle, and an interconnecting tube for the powder flow. 86

Cooley Small Electric Box Furnaces

Two new furnaces of the recirculating air draw type have been added to the line of small electric box furnaces developed by the Cooley Electric Mfg. Corporation, 44 S. Shelby St., Indianapolis 7, Ind. This line of furnaces now includes eleven types and sizes for high- and low-temperature heat-treating of small parts, tools, and dies at temperatures ranging from 2000 down to 300 degrees F.

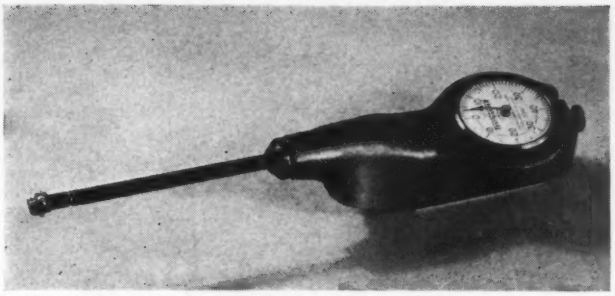
The new forced-circulation furnaces are available in two types, one for temperatures up to 900 degrees F., and the other for temperatures up to 1200 degrees F. Both furnaces provide the accuracy and uniformity required in all precision low-temperature heat-treating operations. They can be used for tempering or drawing both carbon and high-speed steel and for non-ferrous heat-treating. They are especially suitable for tool and die tempering, particularly when the tools are made of high-speed steel, since furnace recovery time is rapid and the double temper of high-speed steel is easily obtained.

The power input of both furnaces is 4 kilowatts at 230 volts. The furnace chambers are completely metal lined, mild steel being used in the 900-degree F. furnace and stainless steel in the 1200-degree F. furnace. The heating chamber is 10 inches wide, 6 inches high, and 14 inches deep. Either furnace will accommodate 50 pounds of parts. The circulating fan is driven by a 1/6- to 1/4-H.P. motor. 87

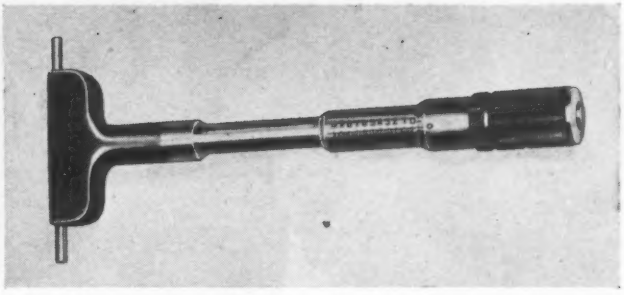


Cooley Small-size Electric Box Furnace

To obtain additional information on equipment described on this page, see lower part of page 240.



Federal Self-centering Gage for Small Holes



"Rimat" Direct-reading Inside Micrometer

Self-Centralizing Gage for Small Holes

A self-centering indicator gage which shows size variations of 0.0001 inch in holes or bores from 0.250 to 0.500 inch in diameter has been added to the line of gages made by the Federal Products Corporation, 1144 Eddy St., Providence 1, R. I.

The gage has fourteen interchangeable extensions which cover the full range of sizes. It can be used to gage holes within its capacity to a maximum depth of 2 1/4 inches, for diameter, roundness, taper, bellmouth, and other inaccuracies. 88

Merz "New-Matic" Gages with Reversed Flow Air Control

To meet the growing demand for precision gages, the Merz Engineering Co., 200 S. Harding St., Indianapolis 7, Ind., has developed a complete line of pneumatic gages known as the "New-Matic," with reversed flow air control. The "reverse flow" principle, developed by the company for use in these gages, provides both a calibrated measurement scale of the required magnification and a "zero" adjustment for returning the calibration to the basic value. The "New-Matic" gages are equipped with continuously variable and adjustable orifices, making possible the control of air volume, as well as air pressure, and thus providing a "balanced air" condition adapted for high-precision measurement. These gages are not merely comparators, but are actually measuring machines, variations from standard dimensions being shown on scales or dials in graduations to meet the user's requirements.

The Merz "New-Matic" gages are made in five models to meet practically all inspection requirements—in the gage laboratory, on high-speed production operations, and for checking finished dimensions at the machines. The Merz "Master" New-Matic, shown in Fig. 1, is available with a standard calibrated scale for any required magnification up to 20,000 to 1. The Merz "Versatile" New-Matic, shown in Fig. 2, is provided with a normal scale covering 0.004 inch and a magnification of approximately 1000 to 1.

Fig. 1. Merz "Master" New-Matic Gage with Magnification up to 20,000 to 1

The company also announces taper gages consisting of two New-Matic gages equipped with a special fixture incorporating large and small taper-gaging rings of hard steel. Variations in taper are registered on one gage to plus or minus 30 minutes in graduations of 5 minutes or, if preferred, to plus or minus 10 minutes in graduations of one minute. Out-of-round condition is shown simultaneously on the second dial in graduations of 0.0001 inch to a total of 0.002 inch. 89

"Rimat" Direct-Reading Inside Micrometer

A new type of inside micrometer called the "Rimat" has been designed by the Richards Machine Tool Co., 124 S. Isabel St., Glendale 5, Calif., to meet the demand for a direct-reading micrometer for measuring internal dimensions accurately, without waste of time or the possibility of error.

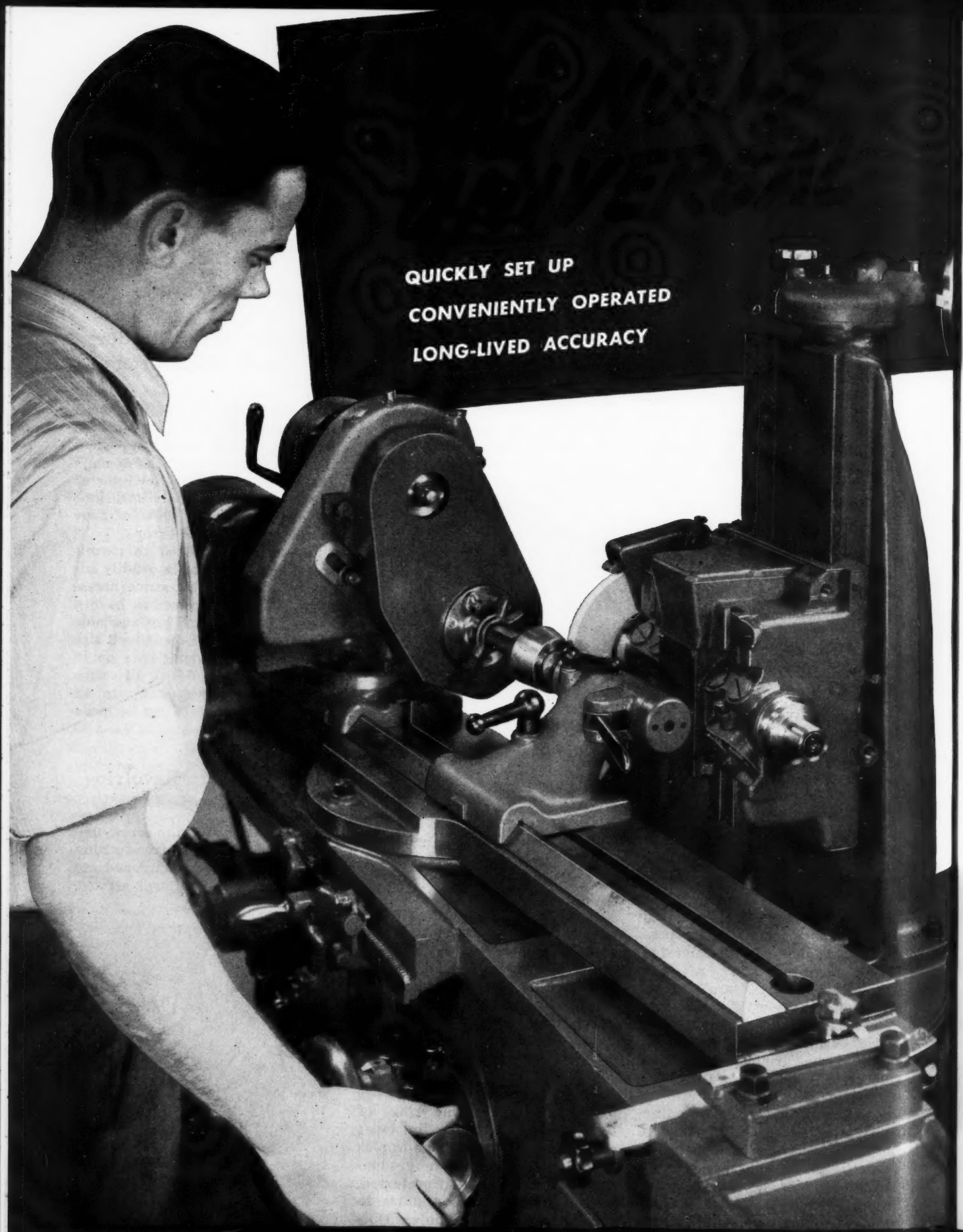
Means are provided to permit wearing surfaces to be readily adjusted, should this become necessary. These micrometers have a range of 1 inch, and are available in two sizes—the 3- to 4-inch size with extra measuring rods up to 6 inches, and the 6-inch size with extra measuring rods up to 12 inches. Special sizes can be made to order. 90

Boyar-Schultz Revolving Stop

A revolving stop for screw machines, which has a free-turning ball-bearing head, hardened to withstand long continued service,

Fig. 2. Merz "Versatile" New-Matic Gage with Magnification of 1000 to 1

To obtain additional information on equipment described on this page, see lower part of page 240.

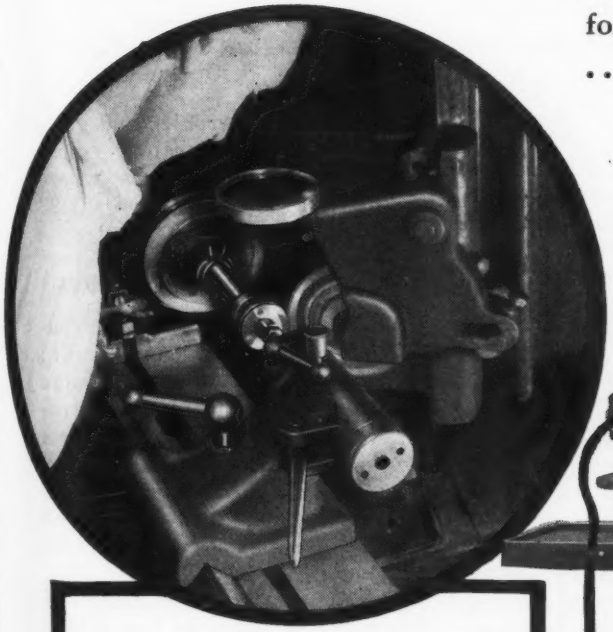


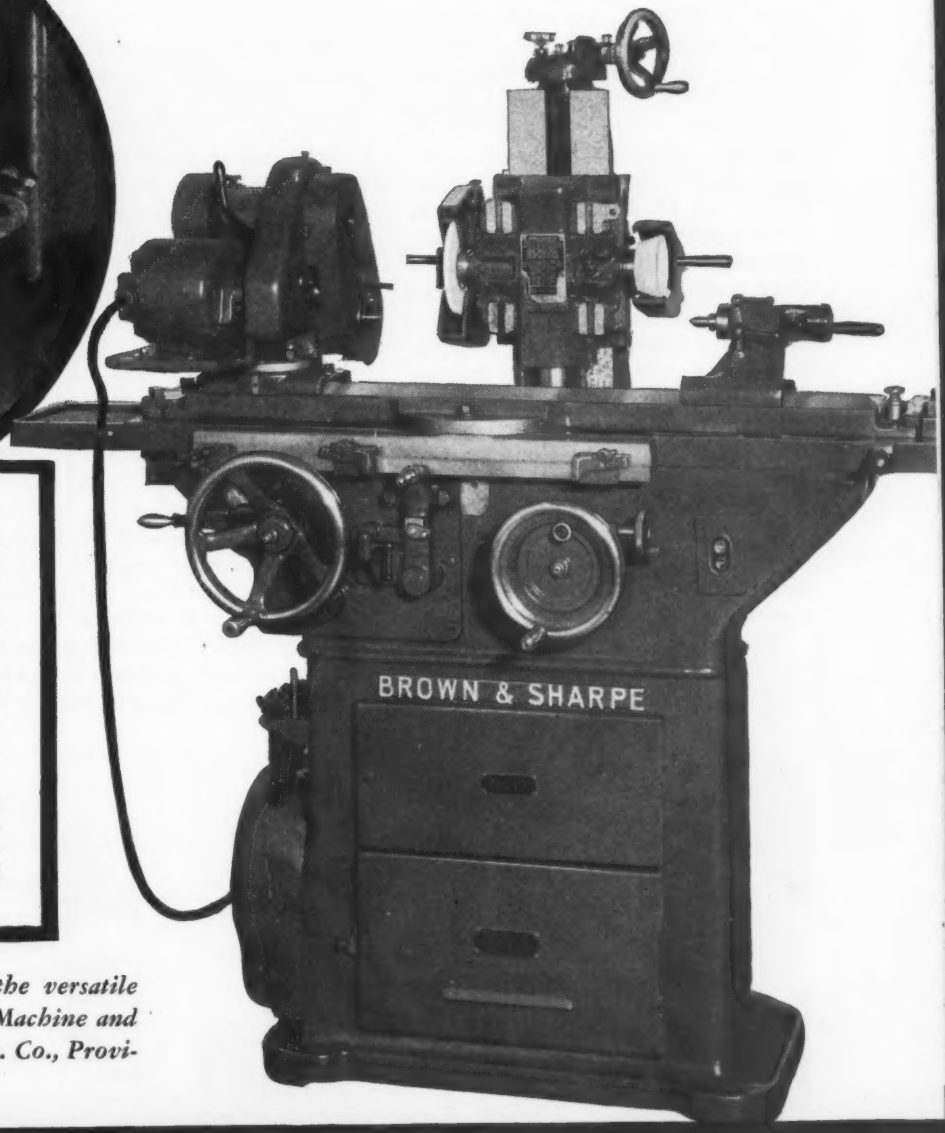
BROWN &

PAYS ITS WAY . . . . IN MANY WAYS

• The No. 13 is one of the busiest machines in any shop . . . for such toolroom operations as grinding small and medium size cylindrical work, form grinding and a multitude of miscellaneous grinding jobs . . . including sharpening milling cutters, reamers and similar tools.

WIDE SELECTION OF ATTACHMENTS TO SPEED GRINDING ON CERTAIN CLASSES OF WORK . . . for sharpening hobs, face mills and formed cutters . . . for surface, internal and wet grinding . . . and an exhaust attachment.





CIRCULAR FORMING TOOL GRINDING EQUIPMENT... Widely used to grind circular forming tools of plain or intricate design and radial and angular forms on the periphery of cylindrical or tapered pieces. Forming tools ground on the No. 13 with this equipment produce more pieces per sharpening, with uniform accuracy throughout the life of the tool.

Above: Through a magnifying glass operator follows the grinding of a forming tool on the No. 13 with the Circular Forming Tool Grinding Equipment.

Write for complete information on the versatile No. 13 Universal and Tool Grinding Machine and its attachments. Brown & Sharpe Mfg. Co., Providence 1, R. I., U. S. A.

SHARPE

B·S

has been brought out by the Boyar-Schultz Corporation, 2110 Walnut St., Chicago 12, Ill. The enclosed ball race of this stop is designed to prevent the entrance of chips and other matter. The stop can be furnished with a soft head, if desired, which can be machined to suit specially formed parts. It is furnished in three sizes, 0.615, 0.740, and 0.990 inch in diameter, and in seven lengths, from 1 3/4 to 5 inches. 91

Ther-Monic Bench Type Induction Generator for High-Frequency Heating

The Induction Heating Corporation, 389 Lafayette St., New York 3, N. Y., has added to its line of electronic heat-treating equipment a Model 43 Ther-Monic 750-watt, low-cost, bench type induction heating generator. This new unit can be used by simply plugging into an ordinary 120-volt, 60-cycle, single-phase power supply outlet. It has a full-load output rating of 43 B.T.U. per minute.

The power section and work applicator of this equipment have been combined in one unit to provide an efficient source of high-frequency energy for speeding up hardening, brazing, soft-soldering, annealing, and melting operations. It is designed for continuous full-load operation in the production line or for short-run work. The coil leads are designed to facilitate frequent work change-overs such as are involved in small-lot production and in experimental or tool-room jobs.

The entire electronic tube equipment consists of one standard heavy-duty air-cooled, shock-mounted oscillator and two standard rectifier tubes. The controls provide for automatic or manual operation. The equipment is fully protected by means of a plate overload circuit-breaker and an instantaneous line circuit-breaker, either of which will automatically shut off the generator if improper line voltage or load conditions occur. The steel cabinet containing the unit is 29 inches long, 16 1/2 inches high, 19 5/16 inches deep, and is equipped with four recessed handles to facilitate moving.....92

Goggle for Protecting Eyes from Fine Dust and Special Lenses for Glass Blowers

A new goggle recommended for use where fine dust particles and powder create a severe eye hazard, especially on compressed air and other industrial operations, has been announced by the American Optical Co., Southbridge, Mass. In addition to protecting the eyes against dust this goggle provides exceptional wide-angle vision, good ventilation, maximum comfort and safety. It is available with Super Armorplate or 6 Curve Super Armorplate clear or calobar lenses in medium or extra dark shades.

This company has also announced the development of AO6 Curve Super Armorplate Didymium lenses which permit glass workers to look through opaque yellow light emitted by burning sodium and see hidden work areas when performing glass blowing, fusing, and cutting operations. These lenses are designed to help speed up production, reduce spoilage, and prevent headaches caused by eye strain. They are especially

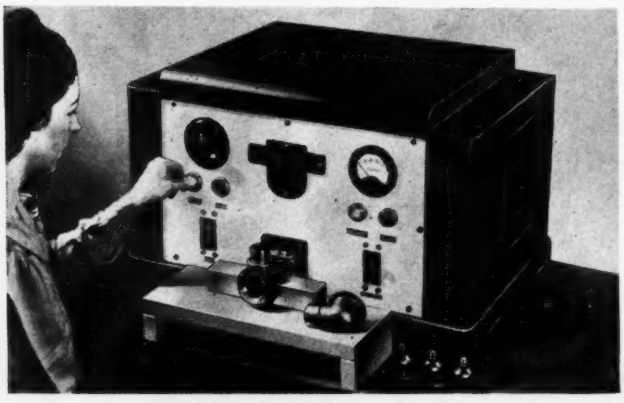
Protective Goggle Brought out by the American Optical Co.

useful in the electronics and glass industries, in laboratory glass blowing, and in all jobs where sodium flare is prevalent. 93

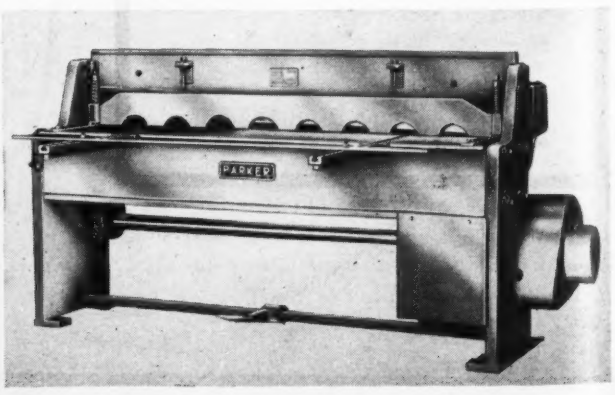
Parker Squaring Shears

The Parker Mfg. Co., 2200 Colorado Ave., Santa Monica, Calif., is now building a new 10-gage power squaring shear from extra-heavy, all-steel welded plate. Parts of this machine are normalized after welding to relieve stresses. The bed, ram, hold-down, and working parts have powerful reinforcements.

The compact box type design of this machine with its low center of gravity assures a minimum of vibration. The shear stands only 47 inches high and weighs 4250 pounds. A 5-H.P. motor operates the machine at a speed of 85 strokes per minute. The cutting length is 73 inches, the blade

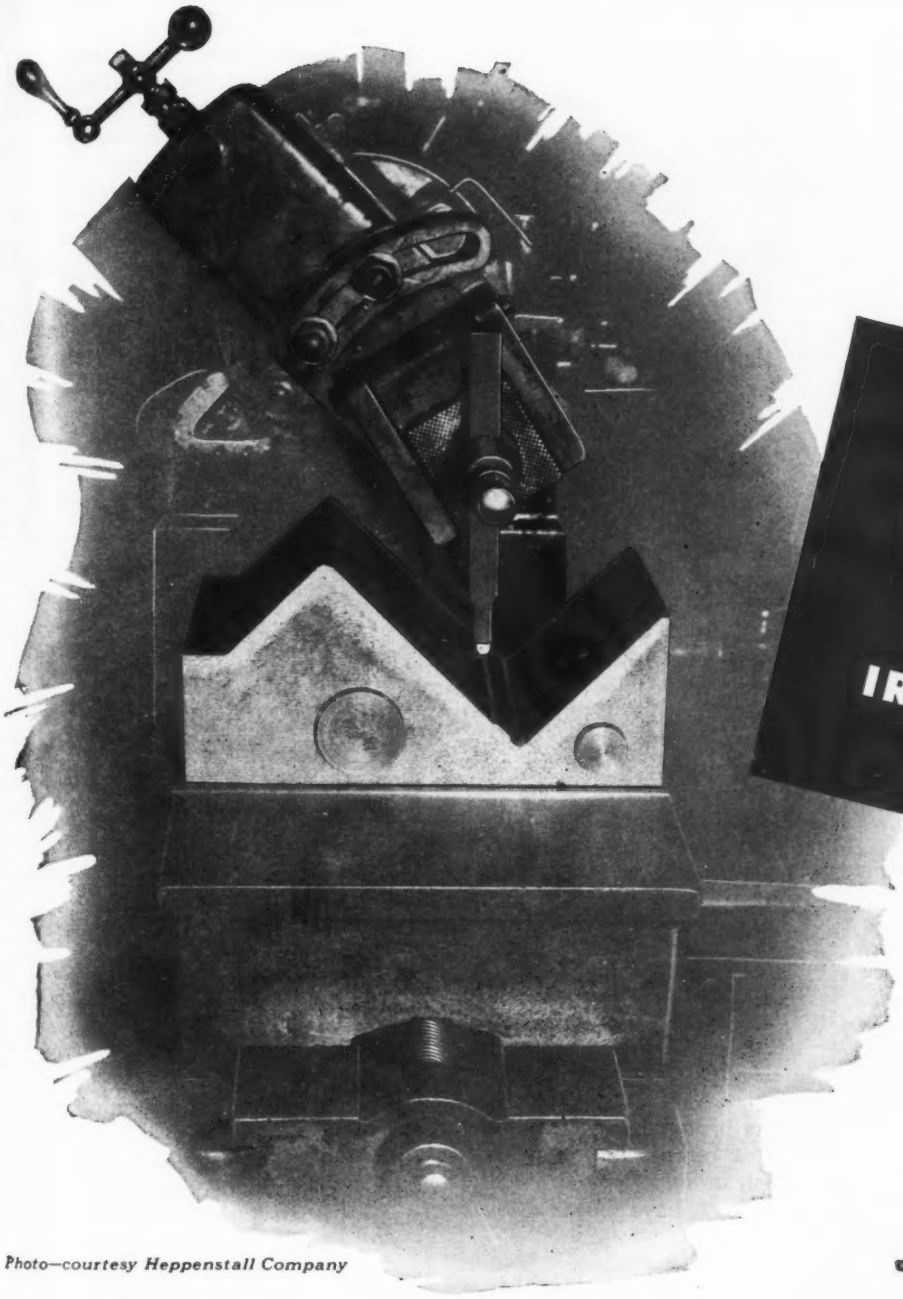


Ther-Monic Induction Generator for High-frequency Heating



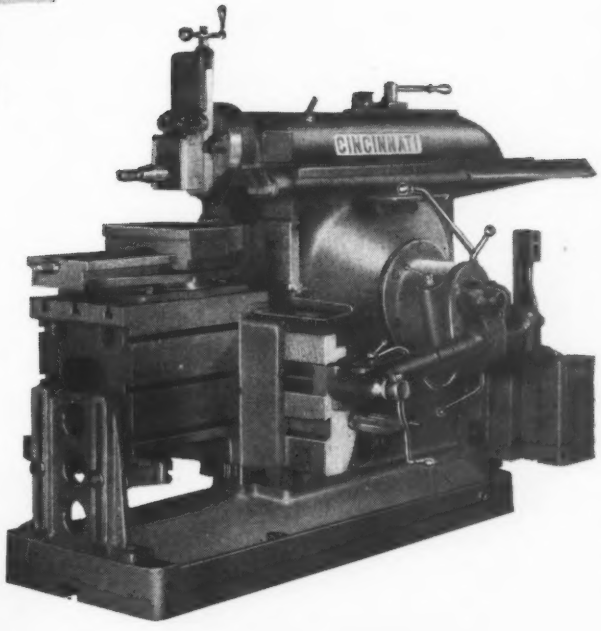
Power Squaring Shears Built by the Parker Mfg. Co.

To obtain additional information on equipment described on this page, see lower part of page 240.



Photo—courtesy *Heppenstall Company*

KNIVES
FOR THE IRON WORKER



It's tough cutting to shape alloy steel knives for the Iron Worker.

Cincinnati Shapers have the power and stamina for this job—they are dependable, and where tough cutting is needed they turn in a fine performance.

On maintenance work, on small lot manufacturing, and in the tool room, they are profitable machines because they make a tough cut with accuracy, and are equipped for quick setups and easy, rapid control.

Write for Shaper catalog N-3, and the Bulletin, Setups for Cincinnati Shapers.

THE CINCINNATI SHAPER CO.

CINCINNATI 25, OHIO U.S.A.

SHAPERS · SHEARS · BRAKES

length being 75 inches. The back-gage range is 18 inches, the front-gage range 38 inches, and the floor space required for the machine 32 by 104 inches. Oil-hardened tool steel four-edged blades are employed. 94

Ingersoll-Rand High-Cycle Impact Wrenches

The Ingersoll-Rand Co., 11 Broadway, New York 4, N. Y., is manufacturing a high-cycle electric impact wrench designed for high-production use on the assembly line. This wrench is made in two models—the 6-pound 10-ounce 4E model for applying nuts and cap-screws with thread sizes up to 3/8 inch, and the 15-pound 8E model for thread sizes up to 5/8 inch.

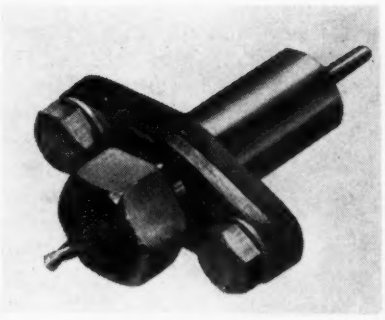
These wrenches are essentially a combination of powerful light-

High-cycle Impact Wrench Made by the Ingersoll-Rand Co.

weight high-cycle motors combined with the Ingersoll-Rand impact unit that has previously been available in the air-driven tools of this company's manufacture. The new wrenches are claimed to be the smallest and most powerful nut-running tools in their class. Absence of torque reaction is said to result in easy and safe handling. The motor is protected from burn-outs, since it is not stalled when the socket-driver unit becomes stalled. 95

Erickson Adjustable Floating Tool-Holder

Erickson Tools Division, 2309 Hamilton Ave., Cleveland 14, Ohio, has brought out an improved adjustable floating tool-holder for use on B & S 00 automatics. This



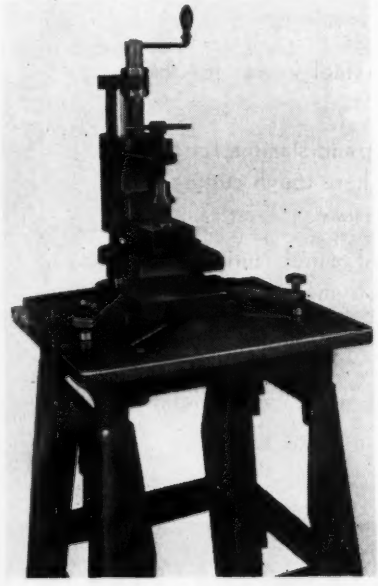
Erickson Improved Floating Tool-holder

holder has been redesigned with heavier flanges and adjusting screws to withstand wear and the strain of heavier cuts. Overhang has been reduced to 27/32 inch to increase rigidity and accuracy and to provide maximum clearance.

Each size collet has a collapsibility range of 1/32 inch, the same as preceding models. The holder is designed to grip the tool securely and uniformly along the entire length of the collet. The collet capacities range from 1/4 inch down to a No. 80 or 0.013-inch drill. 96

Producto Punch-Holder Remover

The Producto Machine Co., 990 Housatonic Ave., Bridgeport 1, Conn., has brought out a machine designed to remove punch-holders from die beds and to separate die members that have been assem-



Punch-holder Remover Made by the Producto Machine Co.

bled for some time. The machine can also be used for shearing-in small punches and dies and for general utility work in a tool-room or maintenance department.

It is arranged for clamping the movable holder about the shank and then lifting the punch-holder off the liner pins and the punch out of the die. If there is no shank on the punch-holder, the device can be made to grip this member by screwing down the auxiliary clamping screw. 97

Tumico Micrometers with Tubular Frames

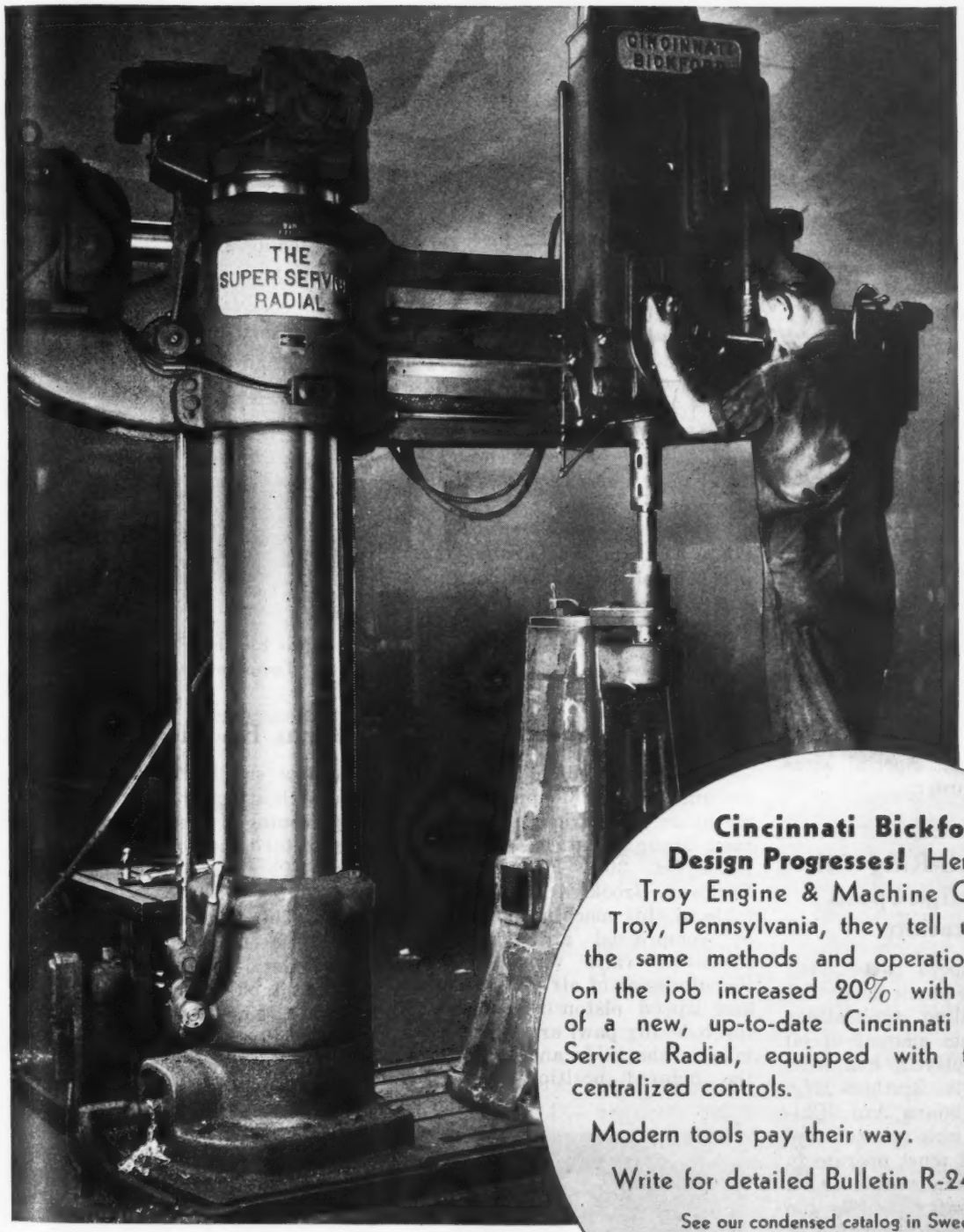
Micrometers with Light-Weight Tubular Frames

Light-weight tubular-frame structure is an outstanding feature of the new "Tumico" micrometers manufactured by the Tubular Micrometer Co., St. James, Minn., which enables these instruments to be handled with minimum effort. Structural weight is said to have been cut as much as 50 per cent by the tubular construction. This factor is claimed to offer greater freedom of movement with lighter "touch and feel" thus improving precision measuring results.

Other features of these tools include take-up spindle bushing assembly, which compensates for wear at the frame; and provision for taking up micrometer thread wear at three points—on the spindle, at the tip, and on the thread. Both the spindle and anvil are hardened to Rockwell 64 C to reduce wear. The frame parts are electroplated with copper, nickel, and chromium. These micrometers are furnished in a variety of types to meet numerous precision measuring requirements. Conventional types range in size from 0 to 24 inches. 98

To obtain additional information on equipment described on this page, see lower part of page 240.

FOOD for thought!



Courtesy of Troy Engine & Machine Co., Troy, Pa.

Cincinnati Bickford Design Progresses! Here at the Troy Engine & Machine Company, Troy, Pennsylvania, they tell us that with the same methods and operations production on the job increased 20% with the installation of a new, up-to-date Cincinnati Bickford Super Service Radial, equipped with the latest type centralized controls.

Modern tools pay their way.

Write for detailed Bulletin R-24A.

See our condensed catalog in Sweet's File.

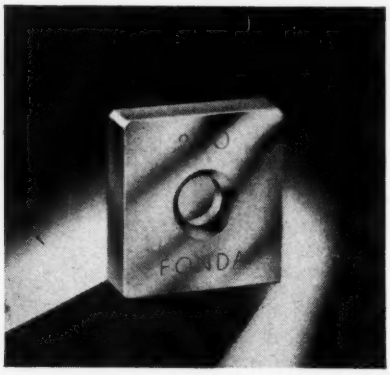
RADIAL AND UPRIGHT SUPER SERVICE DRILLING MACHINES

Equal Efficiency of Every Unit Makes the Balanced Machine

THE CINCINNATI BICKFORD TOOL CO. **Cincinnati 9, Ohio U.S.A.**

Fonda "Lifetime-Carbide" Gage-Blocks

The Fonda Gage Co., Stamford, Conn., has added a line of square "Lifetime-Carbide" gage-blocks to its regular line of gages. The new square style blocks are being manufactured in Grade A within limits of plus or minus 0.000005 inch; in Grade B, which is held to limits of plus or minus 0.000008 inch; and in the full range of sets and sizes previously available only in the rectangular "Lifetime-Carbide" gage-blocks. Individual blocks range in size from 0.050 inch to 4 inches. Complete sets



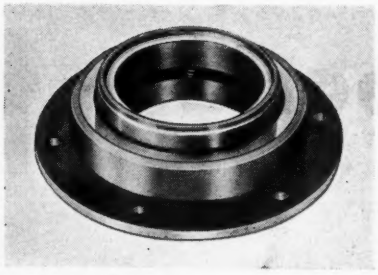
Fonda Square Type "Lifetime-Carbide" Gage-blocks

are also made up of thirty-five and eighty-two pieces. Special sizes can be made to order. 99

Gits Carbon-Ring Oil Seal for High-Speed Applications

A new high-speed carbon-ring oil seal said to be particularly well adapted for sealing applications where a minimum amount of oil lubricant is employed, has been brought out by Gits Brothers Mfg. Co., 1846 S. Kilbourn Ave., Chicago 23, Ill. The new seal can also be used where it must operate in a liquid other than grease or oil or where the shaft speed is too high for satisfactory operation of a bronze ring, even though a good supply of oil is available.

These new carbon rings have a low coefficient of friction and self-lubricating qualities. The carbon seal also has the advantage of being heat-resistant, not subject to warping, chemically inert, and corrosion resisting. The entire



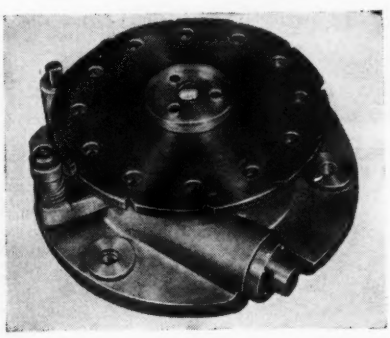
Carbon Seal Ring for High-speed Shafts Made by the Gits Brothers Mfg. Co.

assembly, known as the Gits "DMC" and "DPC" high-speed carbon-faced seals, has been especially developed to eliminate wear on the shaft and thus prevent the necessity for replacing shafts that have become grooved by the seals.

The carbon rings are said to serve as an effective seal against the leakage of liquids or gases under pressure or vacuum, through the use of a radial joint obtained by positive contact between a stationary lapped seal surface built into the unit and a rotating lapped seal surface. The seals can be applied to both horizontal and vertical shafts. 100

Allen Dial-Feed Table

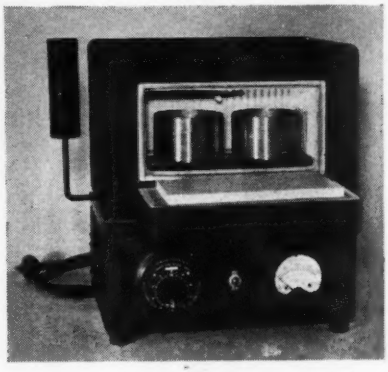
An air-operated dial-feed table designed for easy application to machines of various kinds has been brought out by the A. K. Allen Co., 3011 Fort Hamilton Parkway, Brooklyn 18, N. Y. The table of this machine is operated by compressed air through a three-way valve which controls the admission of air to a hardened and lapped piston that operates the indexing pawl arm. The pawl indexes the table and locks it in the indexed position until the



Allen Air-operated Dial-feed Table

valve is released, allowing a spring to return the pawl ready for the next indexing movement. The tables have been designed and built to withstand the hard service to which high-speed automatic machinery is subjected. They are very accurately graduated, and will retain their accuracy for millions of cycles, since the locking means provided automatically compensates for wear.

Parts can be ejected from the index-plate by an arm attached to the ram or by compressed air from below, which blows the piece upward into a deflector "lead away" chute. 101



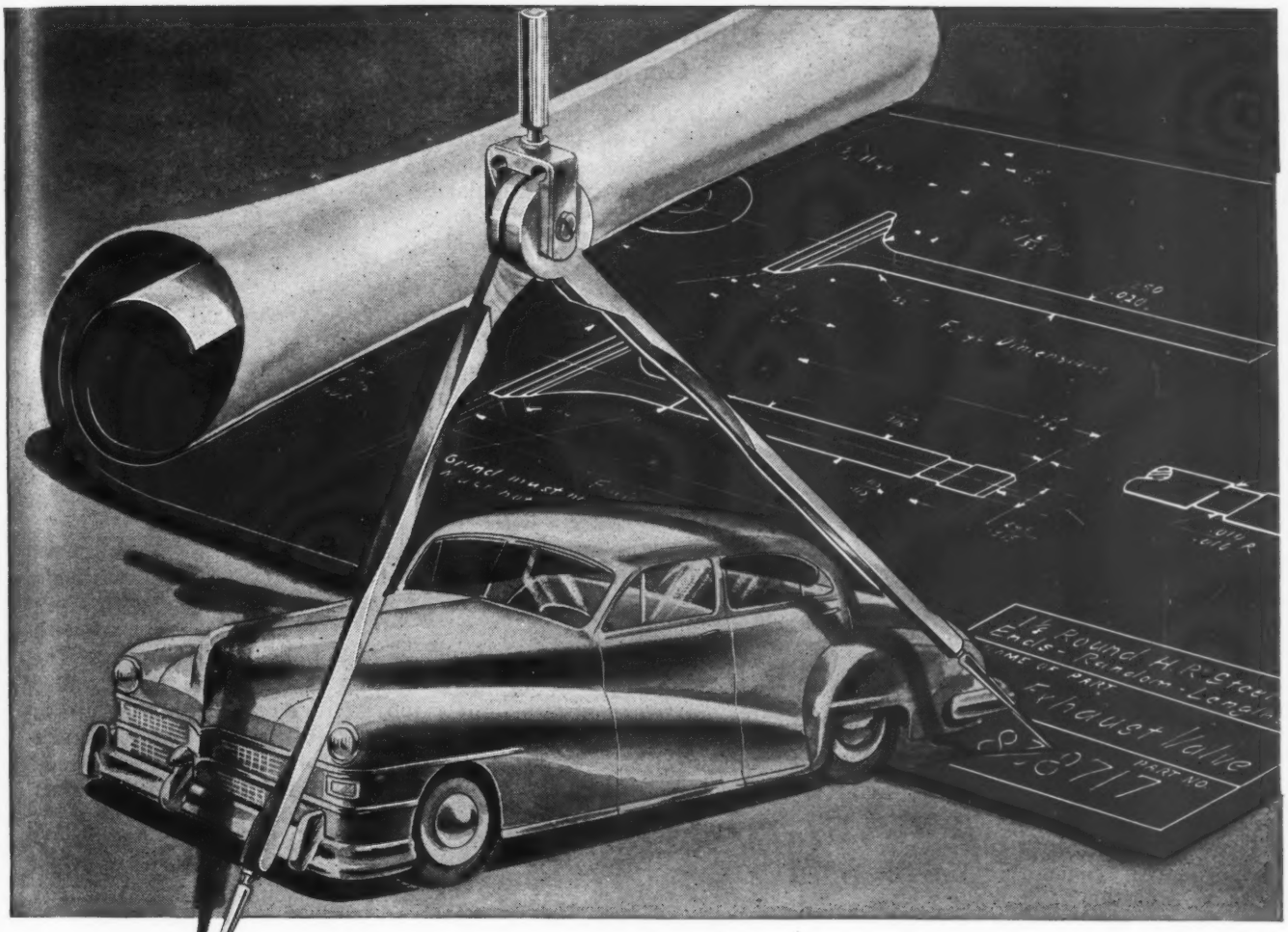
Jelrus Electric Furnace with Temperature Control

Jelrus Electric Furnace

A new small-size electric furnace with attached pyrometer and a "percentage" timer for accurate temperature control has been announced by the Jelrus Co., Inc., 136 W. 52nd St., New York 19, N. Y. This furnace has been designed especially for laboratory or experimental shop work, but is also adaptable to enameling, heat-treating, chemical drying, and other small-scale production heating operations.

The inside dimensions of the muffle are 4 3/8 by 4 inches, and the door opening is 9 inches wide. The wide, low-height proportions of this muffle are a departure from conventional design, and were adopted to allow several pieces to be inserted or removed without disturbing the remaining parts. The "percentage timer" is arranged to maintain any temperature between 100 and 1800 degrees F. or it can be used to regulate the rate at which the temperature is raised to any desired point. 102

To obtain additional information on equipment described on this page, see lower part of page 240.



ALL THE GOOD NEWS COMES FROM PRODUCTION EFFICIENCY

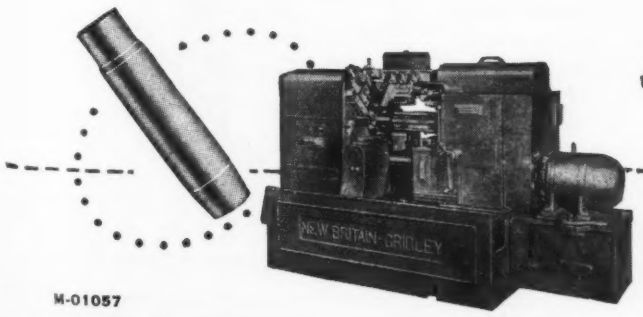
PAYING for higher wages and maintaining profits by raising prices is a sure formula for stagnation.

Lowering prices at the expense of wages or earnings on investors' savings produces the identical result.

Lower *costs*, resulting from *greater manufacturing efficiency*, is the answer. Here is something management and labor agree on wholeheartedly. But you don't *get* it by agreeing about it.

Engineers, by designing new automatic machines, new tools, and new set-up methods, have offered the key to solving the problem. It's up to management to make these better machines and methods available. It's up to the man at the machine to use that machine for all it's worth.

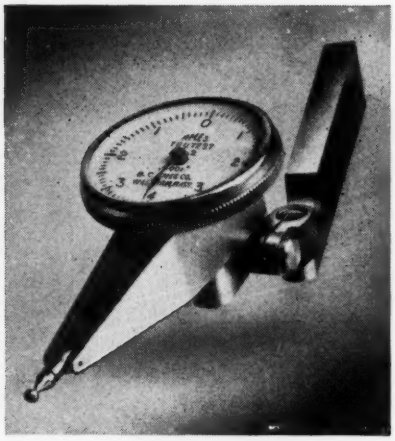
EXAMPLE: Formerly a leading automotive manufacturer found it necessary to rough grind the O.D. of this valve stem guide, machine the I.D. and then finish grind the O.D. Today the outside diameter is finish ground before being magazine fed into a Model 60 New Britain screw machine, which turns out over 406 pieces per hour with concentricity between inside and outside diameters well within the required .002 total indicator reading. Here is a sound saving, which, repeated in thousands of thousands of parts makes an important contribution to lowered costs.



M-01057

New Britain
Automatics

THE NEW BRITAIN MACHINE COMPANY
NEW BRITAIN-GRIDLEY MACHINE DIVISION
NEW BRITAIN, CONNECTICUT



"Trutest" Indicator Made by the B. C. Ames Co.

Ames "Trutest" Indicator

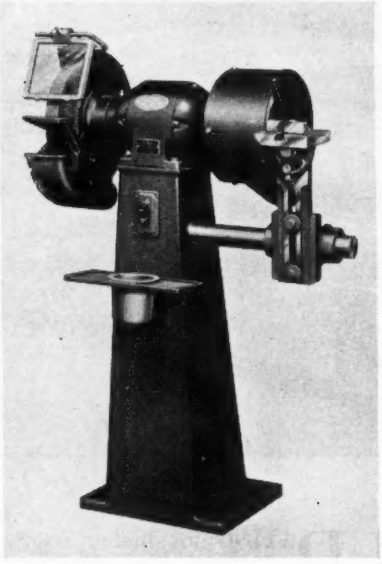
Automatic reversible action that eliminates the tripping of a latch in changing from "over" to "under" work, is a feature of the new universal indicator known as the "Trutest," which is being manufactured by the B. C. Ames Co., 27 Ames St., Waltham 54, Mass. This indicator (for which patents are pending) has another time-saving feature in the form of an indicator hand which always moves in a clockwise direction, regardless of whether the top or the bottom of the contact point is in use. The contact finger can be easily swiveled to the desired angle, which is maintained without slippage. The dial is 1 3/16 inches in diameter, and the contact points, staffs, and pinions, are all of hardened steel, the pivots being burnished after hardening.

Two clamping or support lugs are cast integral with the bronze casing and accommodate beryllium copper clamps designed to obtain rigid support for the indicator. The Ames patented bezel wire, dial, and unbreakable crystal construction are employed to give maximum protection and yet permit easy removal. All parts of the indicator are chromium plated.

The indicator is furnished with two contacts—0.100 and 0.031 inch in diameter. Two support bars are also provided, one being 1/4 inch wide for toolpost work, and the other 1/8 inch wide for height gage work. Two models of the same dimensions are available, one reading to 0.0005 inch, and the other to 0.0001 inch. All contacts are interchangeable in the two models. 103

Bradford Carbide-Tool Grinder

The Bradford Machine Tool Co., Cincinnati 4, Ohio, is manufacturing a new carbide-tool grinder designed for mounting a regular grinding wheel for rough work on the left-hand side and a cup-wheel for performing accurate finish grinding work on the right-hand side. The precision-machined work-table is adjustable for angular grinding, height, and compensation for wheel wear. Eye shield, tool tray, water pot, and guards



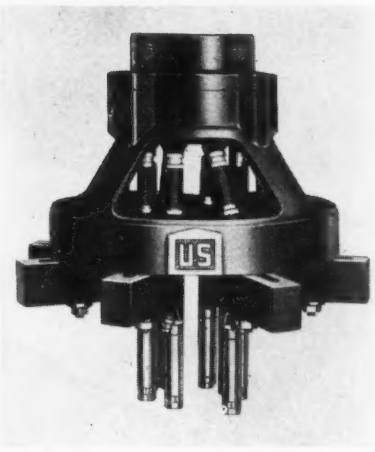
Carbide-tool Grinder Made by the Bradford Machine Tool Co.

with exhaust connections are supplied as regular equipment. The motor is entirely enclosed. 104

Multiple Adjustable-Spindle Drill Head

A multiple-spindle drill head with flexible-joint adjustable spindles which give it additional flexibility is being manufactured by the U. S. Drill Head Co., Cincinnati 4, Ohio. This drill head has eight spindles mounted in Oilite bearings and special heavy-duty ball thrust bearings, which can be adjusted to a minimum distance between spindles of 11/16 inch anywhere within the area of a circle 6 inches in diameter.

The minimum-diameter bolt circle on which equally spaced holes can be drilled with three and four spindles is 1 inch; with five

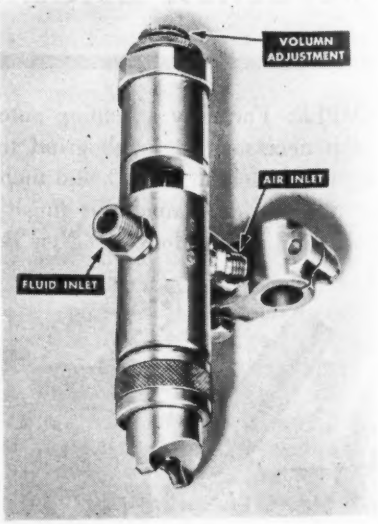


Multiple-spindle Drill Head Made by the U. S. Drill Head Co.

spindles, 1 1/8 inches; with six spindles, 1 3/8 inches; with seven spindles, 1 1/2 inches; and with eight spindles, 1 3/4 inches. The maximum bolt-circle diameter for any number of spindles up to eight is 6 inches. The maximum size drill that can be used in each spindle is 1/4 inch. This head has a total weight, including the eight spindles, of 21 pounds. It is suitable for mounting in any sensitive drilling machine. 105

Siefen Spray Gun for Applying Buffing and Polishing Compounds

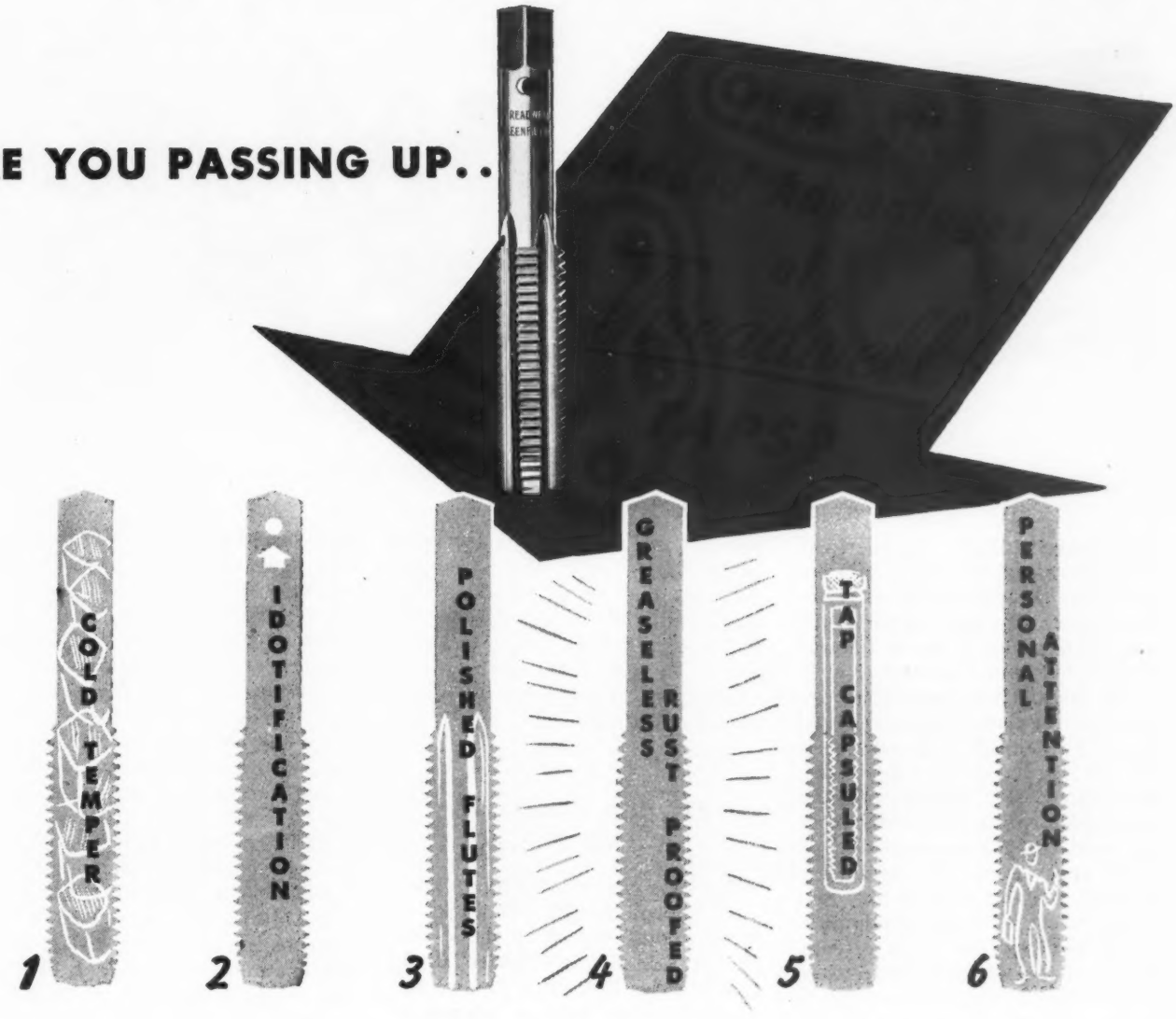
An air-operated spray gun designed for spraying liquid compounds on buffing and polishing wheels is being manufactured by the J. J. Siefen Co., 5657 Lauder-



Siefen Air-operated Spray Gun

To obtain additional information on equipment described on this page, see lower part of page 240.

ARE YOU PASSING UP..



Why be satisfied to string along with ordinary high speed taps that are no better in quality and accuracy and do not give you these extra performance and convenience features of Threadwell Taps.

Why?—when they cost you nothing!

Specify *Threadwell* next time and see for yourself how much more these six extras give you for your tap money.

1. **COLD-TEMPER** — deep-freeze treatment at 120° below zero to give Threadwell Taps extra hardness without brittleness.
2. **"I-dot-ification"** — *red* dot on the shank identifies cut thread, *white* dot commerical ground, *blue* dot precision ground.
3. **Polished Flutes**—reduce danger of chip clogging and breakage.
4. **Greaseless Rust-Proofed** — to keep them clean, dry and shining — never messy and sticky.
5. **Tap-Capsuled** — to provide perfect protection for ground threads and make it easy to select the right tap before unwrapping.
6. **Personal Attention Service** — at the factory and at your Threadwell distributor's.

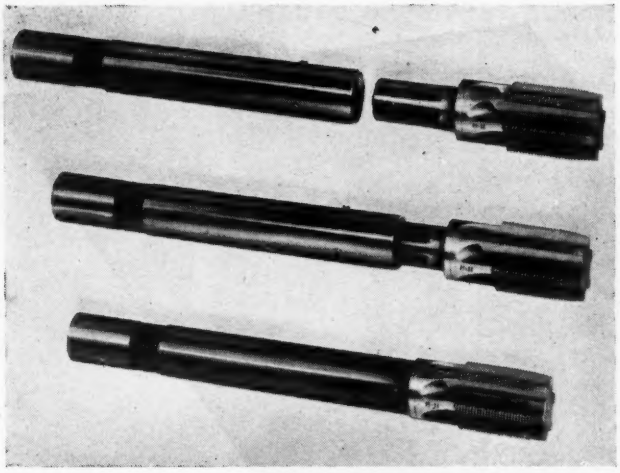
Delivery on standard items now being made from stock

SOLD EXCLUSIVELY BY MILL SUPPLY DISTRIBUTORS THROUGHOUT THE UNITED STATES AND THE WORLD

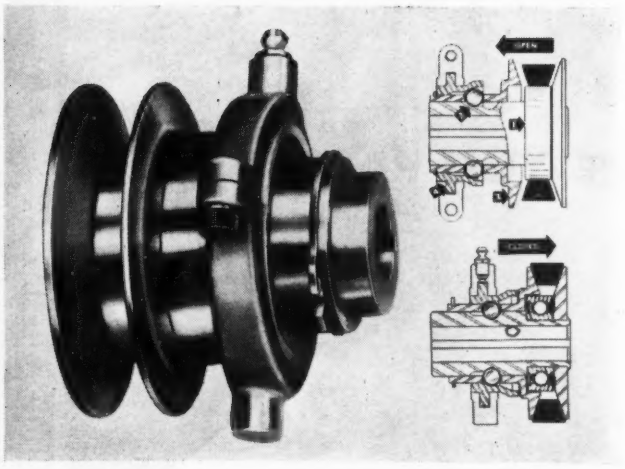
Threadwell
"TAPS OF DISTINCTION"

THREADWELL TAP AND DIE COMPANY • GREENFIELD, MASSACHUSETTS, U. S. A.

CALIFORNIA OFFICE, THREADWELL TAP & DIE CO. OF CALIF., 1322 SANTA FE AVE., LOS ANGELES 21



Detroit Nib Type Taps with Hollow Shanks



"Ball-lok" Friction Clutch for V-belt Drives

dale, Detroit, Mich. As shown in the illustration, the spray gun has inlet pipe connections for air from the shop air line and for the liquid compound, which is fed to the gun by gravity from a container.

The installation includes an air-pressure regulator attached to the shop air line, a flexible tube from the air regulator to a foot-operated valve, and another flexible tube which carries the compressed air from the foot-controlled valve to the spray gun. The spray gun is located above and to the rear of the wheel, with the nozzle positioned to direct the spray of compound on the wheel at the desired angle. There is a volume control at the top end of the gun. With this equipment, the operator can control the application of the compound to the wheel as required, the foot-valve leaving his hands free for holding the work. 106

Nib Type Taps with Hollow Shanks

The Detroit Tap & Tool Co., 8432 Butler Ave., Detroit 11, Mich., has announced the development of "M-11" nib type taps coupled to hollow shanks. These taps have been designed to reduce tool costs, facilitate tapping operations, and increase production. They are especially adapted for tapping pipe couplings, where fairly long-shank taps are normally used, tapping through several parts at a time and allowing the parts to pass over or load up on the long shank. The practice in such cases is to remove the tap from the quick-change type chuck when the shank is filled with pieces and unload the parts. With solid-shank taps, this requires considerable effort during the day's run, and for this reason, the hollow-shank taps, which are said to be 30 per cent lighter than solid-shank types, serve to lessen operator fatigue. 107

Friction Clutch for V-Belt Drives

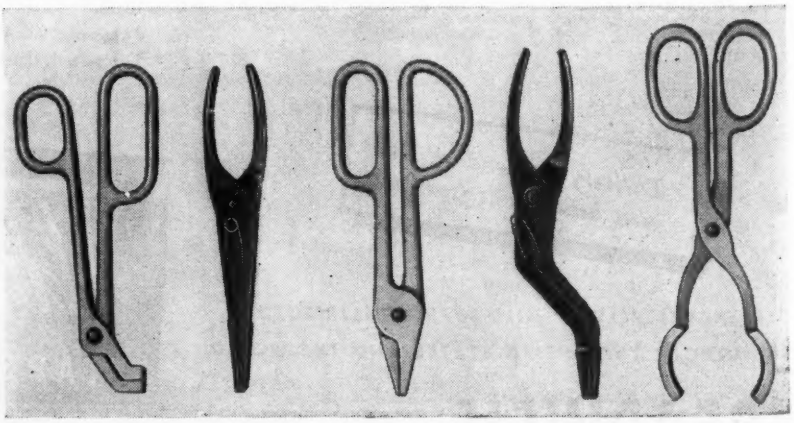
A V-belt friction-drive clutch unit known as the "Ball-lok" is being manufactured by the V-Belt Clutch Co., 3757 Wilshire Blvd., Los Angeles 5, Calif. This clutch is designed to grip or release V-belts. It is furnished in complete clutch units, which can be used either as driving or driven pulleys. In operation, the positive smooth clutch action results from the gripping action of the side walls of the pulley on the V-sides of the belt. When the clutch is opened, the belt slackens and idles on a free-running grease-sealed ball bearing, with no attendant belt drag or creep. A stop-ring prevents over-travel of the cam sleeve in disengaging the clutch.

These clutches are suitable for application in connection with internal combustion engines, motors, tractors, and many other types of machines in which compactness, light weight, flexibility, dependability, and safety are important factors.

The four sizes of clutches in the line have sheave diameters of 3 1/4 to 5 inches and are 2 5/16 to 3 1/16 inches long. Two of the clutches can be applied to 3/4-inch shafts, and two to 1-inch shafts. The weights range from 44 to 54 ounces. 108

Magnesium Tongs and Pliers for Feeding Work to Punch Presses

Five improved types of magnesium tongs and pliers, designed for faster and safer feeding of



Magnesium Tongs and Pliers for Handling Punch-press Work

To obtain additional information on equipment described on this page, see lower part of page 240.

To eliminate vibration...

GISHOLT DYNETRIC*† BALANCERS

Locate and measure the cause, for quick and easy correction of unbalance

Whatever it is—if it rotates, it can be balanced by a Gisholt Dynetric Balancing Machine.

Using electronic means of amplification, the Dynetric picks up unbalance vibrations as small as .000025", locates the source and measures the amount of unbalance by a simple meter indication—all in a matter of seconds.

For the balancing of many parts such as brake drums, cream separator bowls, flywheels, etc., the vertical Dynetric Type S Balancer, shown above, provides utmost ease in mounting and removing work for volume production. It is one of many sizes and types which handle parts weighing from a fraction of an ounce to many tons.

If your product can be improved by eliminating vibration, a Gisholt Dynetric will provide the quickest, most accurate means known for checking and removing the cause—*unbalance.*

**Developed jointly with Westinghouse Electric Corporation.*

†*Trade-Mark Reg. U. S. Pat. Office by Westinghouse Electric Corp.*

GISHOLT MACHINE COMPANY

1209 *E. Washington Avenue* • *Madison 3, Wisconsin*

THE GISHOLT ROUND TABLE *represents the collective experience of specialists in the machining, surface-finishing, and balancing of round and semi-round parts. Your problems are welcomed here.*

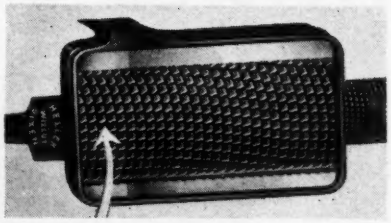
TURRET LATHES • AUTOMATIC LATHES • BALANCERS • SUPERFINISHERS • SPECIAL MACHINES

work to punch presses, have been announced by W. I. Martin & Co., 711 S. Dearborn St., Chicago 5, Ill. These tongs weigh only one-fourth as much as steel tongs, and permit work to be placed in the dies or removed without endangering the operator's hands. They also prevent injury to the dies in the event that the tongs are accidentally caught between the closing dies or press members, since the cast magnesium crumbles to dust under such conditions. The five styles of tools shown in the illustration have been designed to take care of practically every type of punch-press work adaptable to hand feeding. 109

G-E Electronic Positioning Control System

A new electronic positioning control system designed for applications such as the positioning of heavy work in machine tools and the opening, closing, and adjusting of valves and gates from a single coordinated control desk, has just been announced by the General Electric Co., Schenectady, N. Y.

The system consists essentially of a master control station and a follow-up device, which can be either small selsyns or potentiometers, depending upon the application, and an electronic control panel. The driving motor is not included in the system, since any reversing alternating- or direct-current motor of sufficient size to handle the load can be employed. The master control station can be placed in any desired position, since it is connected to the control panel by three control leads. 110



Heller Improved Curved-tooth Non-clogging File

Heller Curved-Tooth Non-Clogging Files

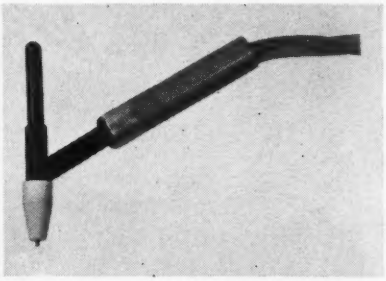
Heller Brothers Co., Newark, N. J., has just added an improved curved-tooth file identified as the "Vixen Wizcut" to its line of files. In addition to the fast-cutting and smooth-finishing properties claimed for the standard file, the new Wizcut has a special self-cleaning or non-clogging feature. This is obtained by employing serpentine-like chip-breaking grooves superimposed on the curved contour of the milled teeth. Tests performed both in the laboratory and in the field are said to indicate that this serpentine-like tooth clears the file of chips readily and avoids loading, even when used on soft metals.

As shown by the close-up view, the file has teeth designed to cut with a genuine shearing action, regardless of whether the file is pushed straight ahead or at an angle. It has no tendency to retain small chips between the teeth, which are frequently a source of scratched surfaces. Thus the file is adapted for producing a smooth finish. It is particularly suited for cutting and finishing such materials as fiber and soft metals which have a tendency to drag or clog the file. 111

Water-Cooled "Heliarc" Welding Torch

A water-cooled "Heliarc" torch designed for inert-gas-shielded arc-welding has been announced by The Linde Air Products Company, Unit of Union Carbide and Carbon Corporation, 30 E. 42nd St., New York 17, N. Y. This torch has a light-weight flexible power cable capable of carrying a current of 250 amperes, a gas cup made of non-conducting material, and an easily adjusted tungsten electrode.

A safety fuse in the water discharge line shuts off the power in case the water flow should stop or the torch should become overheated. Direct current, straight or reverse polarity, or high-frequency stabilized alternating current can be used. It is claimed that metals such as stainless steel, aluminum, Monel, Inconel, and magnesium can be welded rapidly without the use of flux by the use of this equipment. 112

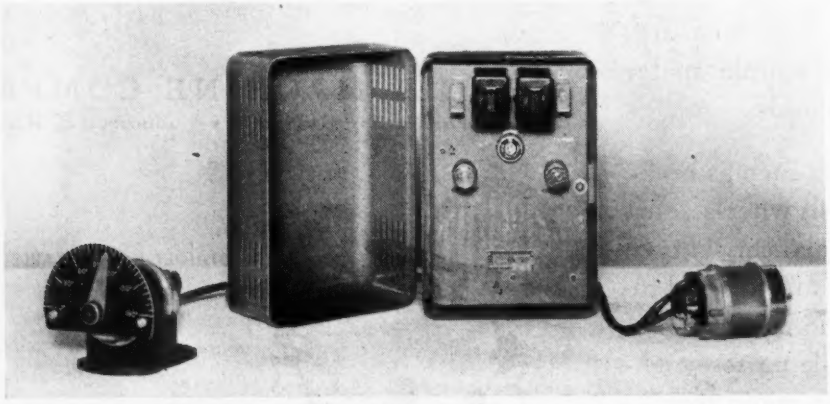


"Heliarc" Water-cooled Welding Torch

Non-Petroleum Synthetic Cutting and Grinding Oil

"Silver Chip No. 60" cutting and grinding oil—a war-time development—is now being produced by Machinery Lubricants, Inc., 31 St. James Ave., Boston 16, Mass., for general use. It is claimed that this new product mixes easily with water of any degree of hardness, and offers a true solution instead of an emulsion.

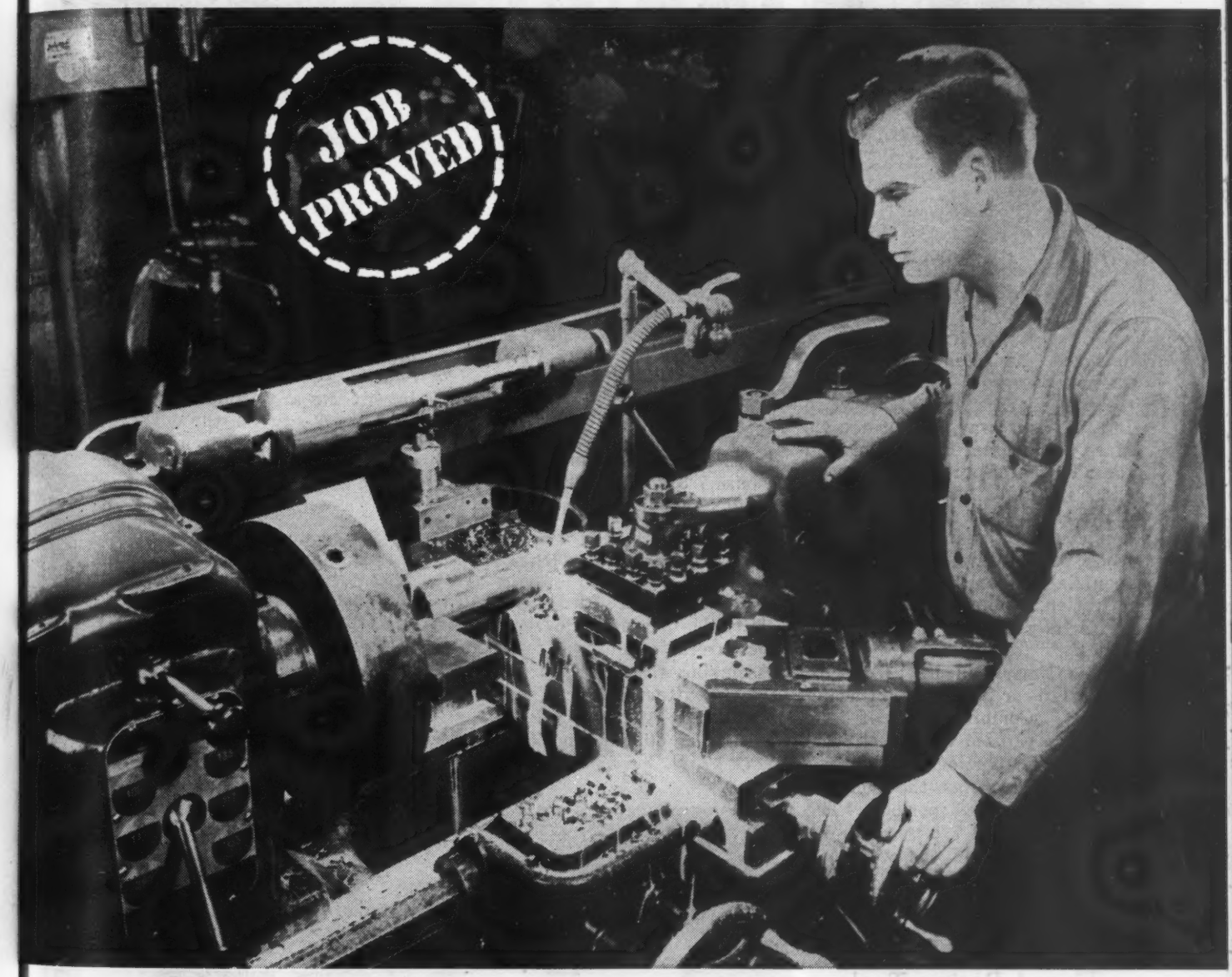
Water mixtures of 1 to 25, 1 to 50, and 1 to 100 are said to provide exceptionally high lubricating qualities and are more transparent than the regular water-soluble cutting and grinding oils or lubricants. 113



G-E Electronic Control System for Positioning Machine Members

To obtain additional information on equipment described on this page, see lower part of page 240.

Turning S.A.E. 4145 Annealed . . . 315 S.F.P.M.



SUNOCO EMULSIFYING CUTTING OIL

Cools and Lubricates Carbide Tool Removing approximately 23 Cubic Inches of Metal per Minute

Here are the facts on a typical job where Sunoco Emulsifying Cutting Oil makes possible heavy cuts on annealed 4145 steel.

- **Operation:** Turning 4½" shaft and removing approximately 23 cu. in. of metal per minute
- **Machine:** 16" x 54" "AMERICAN" Pacemaker multi-production lathe
- **Material:** S.A.E. 4145 annealed steel
- **Spindle Speed:** 280 R.P.M.
- **Depth of Cut:** ⅜"
- **Cutting Speed:** 315 S.F.P.M.
- **Feed:** .017"
- **Type of Tool:** Cemented carbide
- **Cutting Lubricant:** 1 part Sunoco to 20 parts water

Sunoco Emulsifying Cutting Oil forms a stable emulsion when mixed with water. Its lubricating and cooling qualities make it particularly efficient for precision work at high speeds.

For more production . . . better finish . . . longer tool life . . . call your Sun Cutting Oil Engineer or write Department M-6.

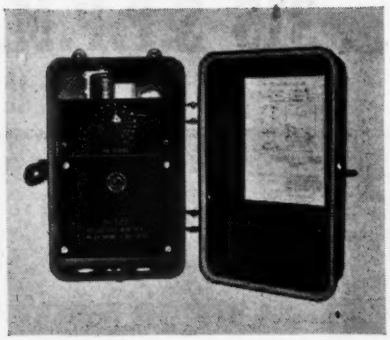
SUN OIL COMPANY • ***Philadelphia 3, Pa.***

Sponsors of the Sunoco News-Voice of the Air—Lowell Thomas

SUN

SUNOCO

INDUSTRIAL PRODUCTS



Photoswitch Welding Timer

Photoswitch Electronic Welding Timer

An electronic welding timer designed for interval timing of welding operations is being placed on the market by Photoswitch Inc., 77 Broadway, Cambridge 42, Mass. This timer is recommended for all general-purpose spot-welders. It fulfills the specifications of NEMA Class 1A timers, and is applicable to manual-, air-, or motor-operated welding equipment requiring either beat or non-beat operation. The adjustment can be set for any interval from 3 to 120 cycles.

This timer can be used with either 115- or 230-volt alternating current. Combinations of the timer can be used when desired to control other portions of the welding cycle, such as the squeeze, heat, cool, and off periods. The dimensions are 9 7/8 by 6 1/8 by 4 1/4 inches, and the weight 8 pounds. 114

Standardized Carbide-Tipped Boring Tools

A comprehensive line of seven basic styles of standardized carbide-tipped boring tools in from four to six sizes each has been announced by the Carboloy Company, Inc., 11107 E. Eight Mile Ave., Detroit 32, Mich. Five of these styles represent additions to the previous standard line of round-shank, square-end tools. The five new styles comprise two types of round-shank tools for 30-degree and 45-degree boring-bars, in four sizes each, and three types of square-shank tools for use in 30-, 45-, and 90-degree boring-bars, in six sizes each. All styles are carried in stock in grades for cutting and boring steel, cast iron, and other materials. 115

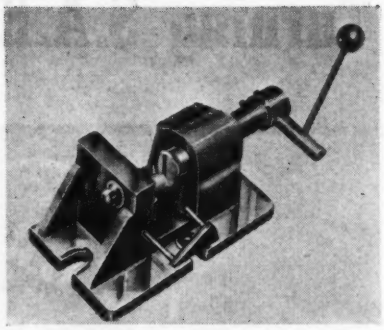
"Kam-Grip" Precision Milling Fixture

A precision milling fixture designed for use on a wide range of production jobs for which special jigs and fixtures are usually constructed is a recent product of Manufacturers Engineering Service, Inc., 415-16 Security Bank Bldg., Toledo, Ohio. This new fixture, known as the "Kam-Grip," is intended primarily for production milling work, but it is also adapted for holding work that is to be tapped, drilled, reamed, deburred, spot-faced, chamfered, or ground. It can be used to advantage in the tool-room and for bench-assembly work, as well.

This new fixture is designed to hold square, round, or hexagonal stock, and has a capacity for holding round pieces from 1/8 inch to 1 1/8 inches in diameter. It has a base 7 3/4 by 4 1/2 inches, and weighs 14 pounds. 116

Improved Airco Electrode

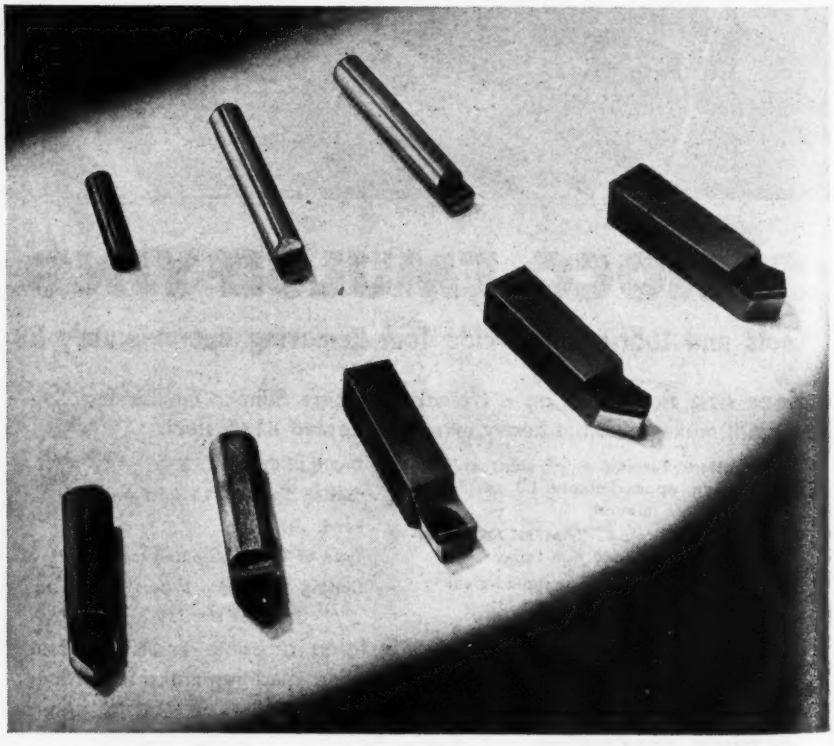
An improved Airco No. 190 electrode, originally developed for the aircraft industry in welding assemblies that were to be heat-treated after welding, has been announced by the Air Reduction Sales Co., 60 E. 42nd St., New York 17, N. Y. This electrode has



"Kam-Grip" Milling Fixture

two important advantages over its predecessor. First, it minimizes the need for preheating when welding high-strength, chrome-molybdenum aircraft steel. Second, it is less conducive to cracking in the areas adjacent to the weld and between the layers of weld metal when preheating is not employed.

The new electrode will give tensile strengths up to approximately 150,000 pounds per square inch, and will produce welds that are more ductile than those previously obtained. It is recommended for operation on direct current, straight polarity, or on alternating current. The medium-long arc is suggested for best results. This electrode can be obtained in 3/32-, 1/8-, 5/32- and 3/16-inch diameters. 117



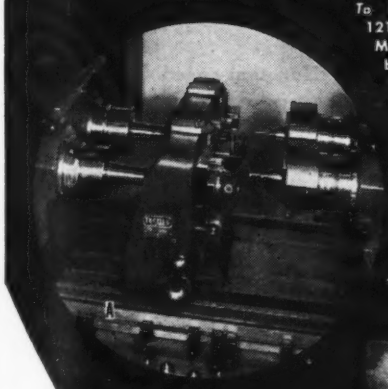
Basic Types of Carboloy Boring Tools Recently Placed on the Market

To obtain additional information on equipment described on this page, see lower part of page 240.

YOU GET ALL 3

with EX-CELL-O *Standard* Precision Boring Machines

For instance: Two connecting rods per minute are rough bored, grooved and chamfered on the standard Ex-Cell-O 1212-A Precision Boring Machine illustrated in circle A to the left. After these operations the rods go on an Ex-Cell-O Style 2112-A Single End Precision Boring Machine for finish boring both holes. Circle B is a close-up view of the tooling on this machine. These methods of machining connecting rods are examples of good production with *comparatively simple tooling* on standard machines. When extremely high production is required, as with automotive connecting rods, larger Ex-Cell-O machines carrying more spindles are used, and parts are hydraulically located and clamped. On the other hand, when production requirements are lower, methods can be further simplified and tooling costs held to a minimum. *If you have a machining problem where accuracy, production and economy are essential, get in touch with* EX-CELL-O.



To left: Ex-Cell-O Style 1212-A Precision Boring Machine equipped to rough bore the large hole, chamfer one edge; cut an oil groove and chamfer both edges of the small hole in aluminum connecting rod. Production is 120 pieces p.h.

To right in circle: Finish boring both holes of connecting rods on Ex-Cell-O Style 2112-A Precision Boring Machine. Production with this simple set-up is 137 pieces p.h.

To right: Standard Ex-Cell-O Style 1212-A Precision Boring Machine is a flexible machine tool for accurate boring, turning, facing and similar work at production rates that keep unit costs down. For specifications write for Bulletin No. 31101.

Modern machine tools mean "more goods for more people at lower prices" . . . see 1947 Machine Tool Show in Chicago in September!

XLO
EX-CELL-O Air PRECISION

47—4

EX-CELL-O CORPORATION

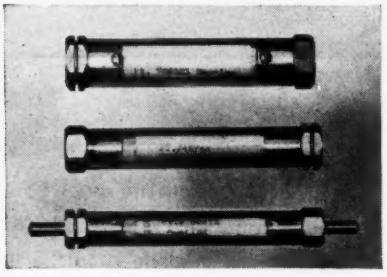
DETROIT 6
MICHIGAN

MANUFACTURERS OF PRECISION MACHINE TOOLS AND CUTTING TOOLS • PRODUCTION PARTS AND SUB-ASSEMBLIES

"Vis-U-Trol" Gage Handle

The "Vis-U-Trol" transparent gage handles shown in the accompanying illustration were brought out by Industrial Development Associates, Inc., 223 Spruce St., Bloomfield, N. J., to eliminate the need of supplying special stamped handles for each size gage. They also permit a record of each gage, in the form of a typewritten card, to be kept in the handle.

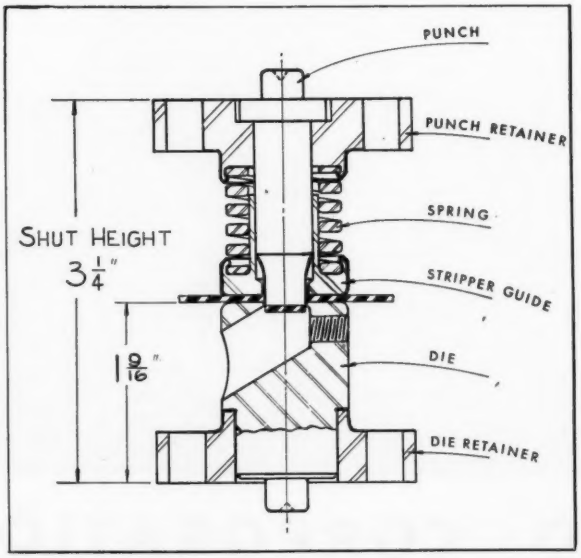
The new gage handle consists of a Lucite tube into the ends of which are inserted the gage plugs. The card bearing the typewritten record is placed in the Lucite tube and the retaining screws inserted and sealed with wax to prevent tampering with the record. The handles are made in Nos. 1, 2, and 3 S A E sizes. 118



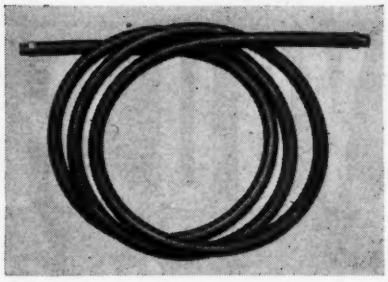
"Vis-U-Trol" Gage Handles

Raar Interchangeable Die Sets

A line of interchangeable self-stripping notching, piercing, and blanking punch and die units with a low shut height of 3 1/4 inches, suitable for operation in small presses, has just been placed on the market by Raar Mfg. Co., 1663 N. Highland, Los Angeles 28, Calif. As shown in the illustration, these dies are drilled and tapped for air-line connections to obtain effective slug ejection. Change or replacement of the punch and die units is easily accomplished, since the stripper and stripper guide can be removed by a half turn. The punch can be removed from the retainer with a light pressure, and changes can be made without disturbing the set-up. 119



Interchangeable Die Set for Small Presses



Water-cooled High-frequency Flexible Conductor

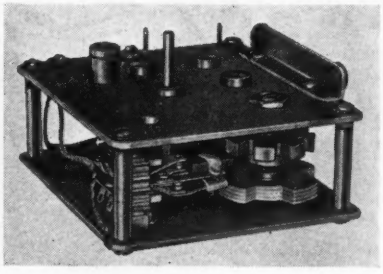
Titeflex High-Frequency Water-Cooled Flexible Conductor

A new type water-cooled flexible conductor for the transmission of high-power, high-frequency current has been announced by Titeflex, Inc., 519 Frelinghuysen Ave., Newark 5, N. J. This conductor consists of a brass water-tight convoluted inner core with an outer braid type conductor. A specially compounded high-frequency flexible insulation is extruded over the outer braid.

The features of the new conductor include water cooling for minimum losses at high power; insulation for high-frequency currents which is flexible and tough and has excellent dielectric properties; remarkable chemical inertness and excellent water resistance; flexibility, which permits freedom of motion between components; and lower power losses than experienced with conventional 1/4-inch copper tube. 120

Constant-Speed Direct-Current Motor

Improvements based on a polarized magnetic drive have been incorporated in a small size, constant-speed direct-current motor developed by the Amglo Corporation, 4234 Lincoln Ave., Chicago 18, Ill. The new motor is small enough to be held in the palm of the hand. It is available for use at 3, 6, 12, 24, 32, or 110 volts, and is adapted for many uses previously considered outside the scope of the direct-current field, particularly in industry and commercial applications requiring synchronous units.



Amglo Constant-speed Direct-current Motor

The current consumption varies from 0.06 to 1 watt when the motor is operated either from a battery or from direct-current line sources. Geared shaft speeds range from 1 revolution for each twenty-four holes up to 100 R.P.M., providing clocklike accuracy previously obtainable only with alternating-current units. 121

Tungsten Electrodes

A new line of tungsten electrodes for atomic-hydrogen and inert-arc welding has been announced by the Electric Welding Division of the General Electric Co., Schenectady, N. Y. These new electrodes are suitable for either manual or automatic welding. They are available in diameters ranging from 0.040 to 1/2 inch and in lengths from 3 to 24 inches. Other lengths up to 60 inches can be furnished on order. The diameters are held to a tolerance of 0.001 inch. 122

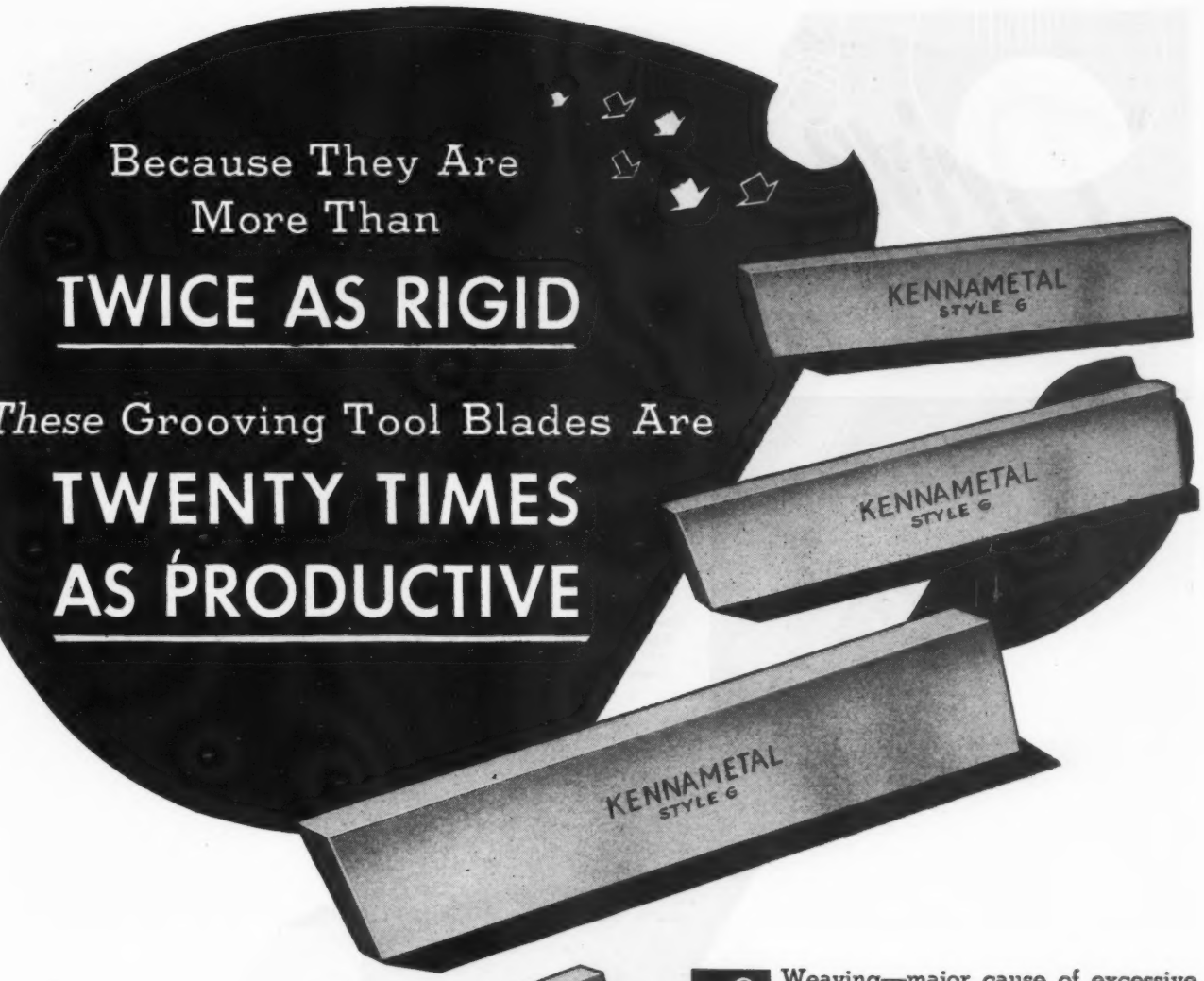
To obtain additional information on equipment described on this page, see lower part of page 240.

Because They Are
More Than

TWICE AS RIGID

These Grooving Tool Blades Are

TWENTY TIMES AS PRODUCTIVE



Weaving—major cause of excessive wear in slender grooving tool blades—can now be overcome by using sturdy, hard blades of solid Kennametal. Here's one example—

In a large automobile plant, solid Kennametal blades are now cutting piston ring grooves in 18,000 to 20,000 aluminum alloy pistons before resharpening, whereas the previously-used carbide-tipped steel-shank tools had to be serviced after cutting grooves in 800 pistons.

These new solid Kennametal blades cut better, longer, not simply because they are much *harder* than steel, *but primarily because their resistance to deflection is two to three times* as great as steel. Weaving that causes erratic cutting pressures, strains, and rapid cutting edge failure is thereby minimized.

Kennametal grooving tool blades are made in standard widths from .080" to .250". Other sizes are available. Ask our nearest representative, or write for prices and particulars.

KENNAMETAL

SUPERIOR CEMENTED CARBIDES

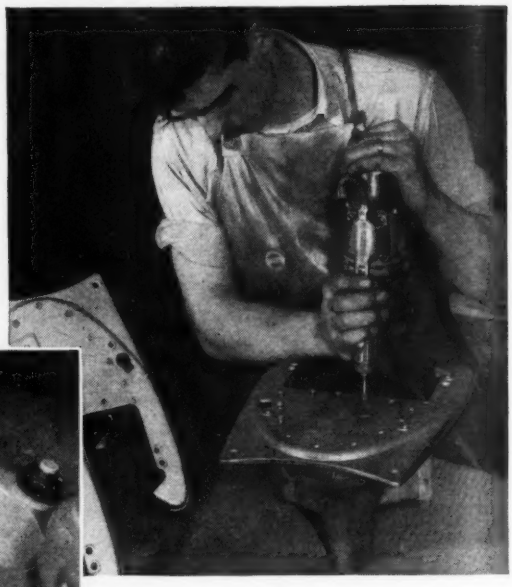
TRADE MARK REG. U. S. PAT. OFF.

KENNAMETAL *Inc.*, LATROBE, PA.

"Drive Faster... set up solid, without burrs" says EVINRUDE

NO WOBBLY STARTS *and slow driving to avoid skids here. Phillips Screws go in fast, set up tight and flush to hold cover of water jacket.*

DRIVING TIME CUT 30% *in fastening base plate to muffler assembly with Phillips Screws. Power driver centers and stays in recess—no slips.*



***TIGHT FASTENING** is essential in joining the two parts of die cast fuel tank, so Evinrude depends on Phillips Screws. Photo shows use of Phillips Screws for attaching nameplate where skids would mean expensive refinishing.*

★ ★ ★

... Key points of another study of assembly savings made with Phillips Screws in leading plants; from report of James O. Peck Co. independent investigator.

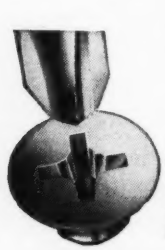
"Obvious assembly savings prompted our use of Phillips Head Screws in the 'Zephyr' Outboard Motor," explained Evinrude's Works Manager, "and results are even better than expected."

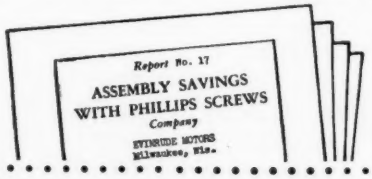
"Phillips Screws make the most of power tool speed. No lost motion as when driving slotted screws. We just bring the driver bit down and it automatically centers and seats in the Phillips Recess. That makes for a very fast operation... and an economical assembly. Also, we avoid driver skids, and subsequent expensive refinishing.

"We have to set 'em up solid, and the Phillips Recessed Head can take the necessary torque without breaking or burring. Outboards often get rough usage, and Phillips Screw fastenings match the sturdiness of the overall construction.

"Dangerous burrs avoided. Workmen can get bad cuts on hands and arms from sharp burrs common to slotted screws. With Phillips Screws, that hazard is banished, and the burr-free, ornamental recess has a much more shipshape appearance.

You'll find good ideas for your assembly operations in the complete report of this and other assembly studies... on metal, wood, and plastic products. Inside facts on modern methods of America's best assembly engineers. FREE—use coupon.





Phillips Screw Mfrs., c/o Horton-Noyes
1800 Industrial Trust Bldg.,
Providence, R. I.

Send me reports on Assembly Savings with Phillips Screws.

Name .....

Company .....

Address .....

18

PHILLIPS *Recessed Head* SCREWS

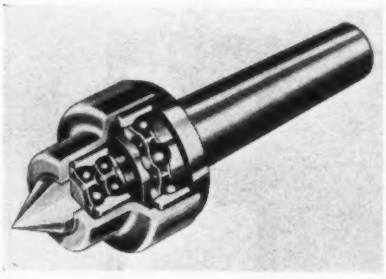
Wood Screws • Machine Screws • Self-tapping Screws • Stove Bolts

23 SOURCES

American Screw Co.
Central Screw Co.
Continental Screw Co.
Corbin Screw Div. of American Hdwe. Corp.
The H. M. Harper Co.
International Screw Co.
Lamson & Sessions Co.
Milford Rivet and Machine Co.
National Lock Co.
National Screw & Mfg. Co.
New England Screw Co.
Parker-Kalon Corporation
Pawtucket Screw Co.
Pheoll Manufacturing Co.
Reading Screw Co.
Russell Burdsall & Ward Bolt & Nut Co.
Scovill Manufacturing Co.
Shakeproof Inc.
The Southington Hardware Mfg. Co.
The Steel Company of Canada, Ltd.
Sterling Bolt Co.
Stronghold Screw Products, Inc.
Wolverine Bolt Company

Sturdimatic Live Center

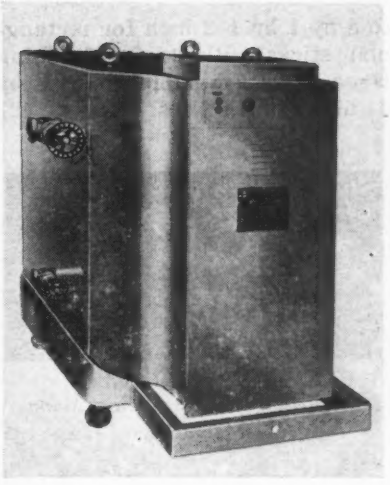
A new type live center with a replaceable alloy-steel point ground true with the bearings has been introduced by the Sturdimatic Tool Co., 5216 Third Ave., Detroit 2, Mich. This live center has a low overhang, and provides a slight cushioning action that compensates for expansion due to heat, shock, and excessive thrust loads, thus reducing wear to a minimum. A large thrust bearing takes all thrust loads and a large radial bearing takes the radial loads. Standard shanks with Morse tapers for this new type of Sturdimatic live center are carried in stock, and Brown & Sharpe, Jarno and other tapers can be supplied to suit specifications. 123



Sturdimatic Live Center

"Vacu-Therm" Plastics Heating Unit

A new heating unit with a "Vacu-Therm" generator, designed to meet the requirements of practically all plastics heating work, has been announced by the Castaloy Corporation, 197 S. Waterman, Detroit 17, Mich. This unit is capable of delivering quick, controlled heat up to 550 degrees F. and holding the required heat to within plus or minus 5 degrees under low operating pressures.

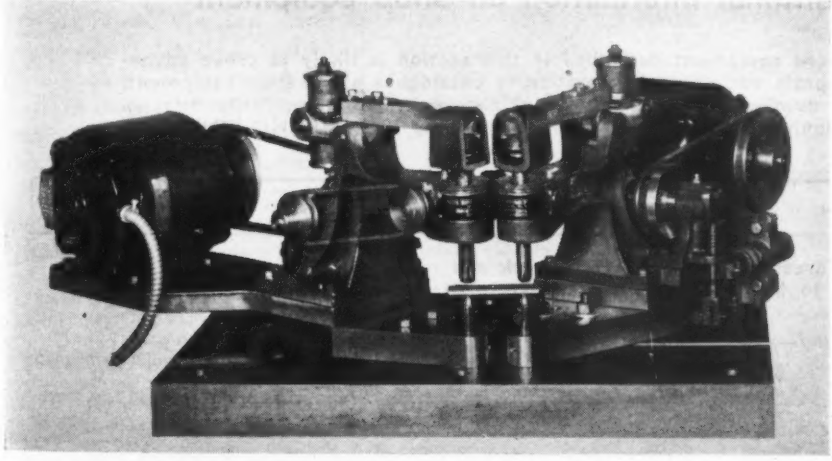


"Vacu-Therm" Heating Unit

The Vacu-Therm generator is a heavily insulated, self-contained unit with no moving parts. Heat transfer is by Dowtherm E sealed in a welded vacuum chamber. This liquid vaporizes when it reaches its efficient operating range and transfers heat to the work through flexible tubes or pipes. The generator is manufactured in 16, 22, and 33 K.W. capacities. It requires a floor space 72 by 36 inches...124

High-Speed Riveting Hammer

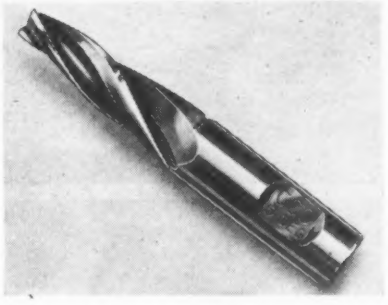
A hammer with twin heads for forming two rivet heads simultaneously has been brought out by the High Speed Hammer Co., Inc., 313 Norton St., Rochester 5, N. Y. This machine has a minimum center distance between heads of 2 3/4 inches, and a maximum center distance of 12 inches. It will handle rivets in sizes from 1/8 to 5/32 inch diameter. The clutch mechanisms of these hammers are hydraulically operated. Units of greater capacity are also available. 125



Twin-head High-speed Riveting Hammer

Cadillac Tapered Spiral Cutters

A complete line of high-speed steel tapered spiral cutters, previously classified as special tools, has been standardized and placed on the market by the Cadillac Cutter Co., 1613 Eastern Ave., S.E., Grand Rapids 7, Mich. This line includes sizes with flutes ranging from 1/2 inch to 3 1/2 inches in length, with small-end diameters from 3/32 to 1/2 inch, and with tapers from 1/2 degree to 7 degrees per side.



Tapered Spiral Cutter Made by Cadillac Cutter Co.

The cutters in this line are adapted for machining dies, molds, patterns, etc., where draft or clearance is required, and they can also be used to advantage on a wide range of general machining operations. 126

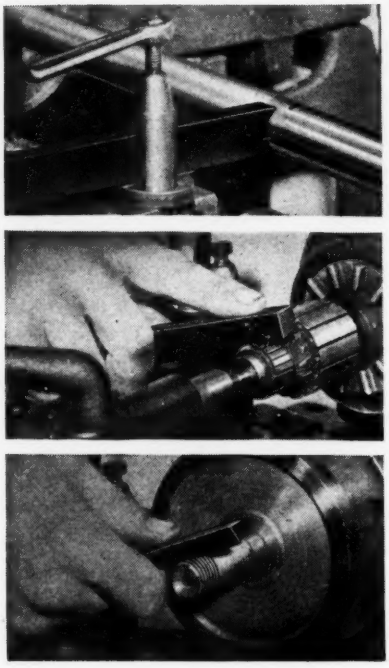
Sandusky Abrasive Sticks

The Sandusky Abrasive Wheel Co., 697 W. Ransom St., Kalamazoo, Mich., has recently added abrasive sticks to its line of grinding and polishing equipment. These abrasive sticks are made of selected abrasive grains bonded in rubber, and may be used either dry or with water. They are available in three grades of abrasive grains and in a wide variety of sizes and shapes for light grind-

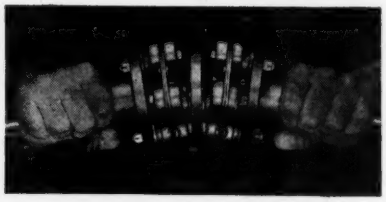
To obtain additional information on equipment described on this page, see lower part of page 240.

ing, cleaning, deburring, rust removal, sharpening, honing, polishing, etc.

An outstanding feature of these sticks is the ease with which they can be cut and shaped for finishing contours, grooves, beads, and other irregular surfaces. It is claimed that they can be easily shaped to any contour by means of a knife, file, grinding wheel, hacksaw, or band saw. Three typical applications are shown in the illustration. The sticks are available in 3-, 6- and 8-inch lengths. The sizes range from 1/4 inch in diameter for the round sticks up to 8 by 1 by 1/2 inch for rectangular sticks. Blocks for finishing large areas are supplied in 4- by 4- by 3/4-inch sizes. 127



Typical Applications of Sandusky Abrasive Sticks



Double Morflex Coupling Made by the Morse Chain Co.

Double Morflex Couplings

The Morse Chain Co., Detroit 8, Mich., has brought out a universal-joint type double Morflex coupling which, in effect, consists of two single Morflex couplings with a center plate adapter. This new unit is said to have twice the torsional resilience obtained with a single coupling. The torsional resilience is obtained through the preloaded neoprene biscuit type construction.

The double coupling accommodates offset and angular misalignment of shafts, and thus serves as a universal drive connection. It also permits constant velocity between the driving and driven members. With no metal-to-metal contact, there is no need for lubrication. The construction eliminates noise and vibration and reduces bearing wear. The new coupling is available in ten sizes, having capacities of 13 to 725 foot-pounds torque. 128

Dake Hydraulic Press

A 25-ton hydraulic press is being built by the Dake Engine Co., 604 Seventh St., Grand Haven, Mich., for use in maintenance, service, and industrial plants. This press has a fast moving ram, increased operating speed being obtained by using an extra large hydraulic pump. The large space between the uprights allows work up to 33 1/2 inches in diameter to be handled. The screw type ram can be advanced by hand to speed up pressing operations.

Hydraulic Press Made by the Dake Engine Co.

Standard equipment includes two combination table and V-blocks, round-nose pressing tool, pressure gage, and table-hoisting mechanism. 129

To Obtain Additional Information on Shop Equipment

Which of the new or improved equipment described in this section is likely to prove advantageous in your shop? To obtain additional information or catalogues about such equipment, fill in below the identifying number found at the end of each description—or write directly to the manufacturer, mentioning machine as described in June, 1947, MACHINERY.

No.	No.	No.	No.	No.	No.	No.	No.	No.	No.

Fill in your name and address on blank below. Detach and mail within three months of the date of this issue to MACHINERY, 148 Lafayette Street, New York 13, N. Y.

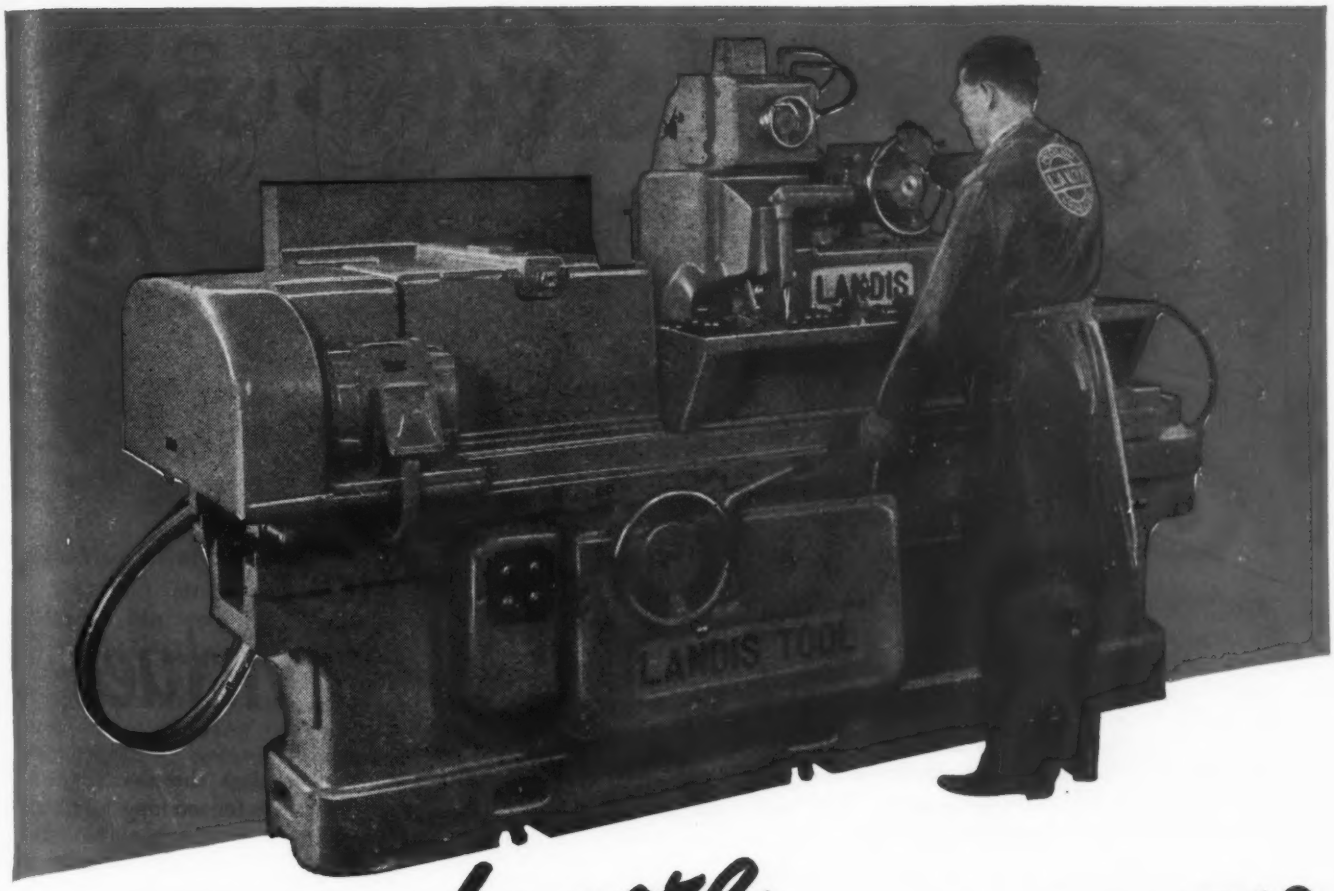
NAME.....POSITION OR TITLE.....

[This service is for those in charge of shop and engineering work in manufacturing plants.]

FIRM.....

BUSINESS ADDRESS.....

CITY.....STATE.....



Grind more pieces PER WHEEL DRESSING

AN EFFECTIVE grinding coolant must 1) settle grinding dirt quickly, and 2) prevent rust. Emulsions prepared with *Texaco Soluble Oil D* (or, where water is particularly hard, with *Texaco Soluble Oil HW*) have these two essential characteristics.

Quick settling of grinding dirt from *Texaco Soluble Oil D* emulsions prevents wheel loading and means increased production and lower operating costs. You can grind faster and smoother, get more pieces between wheel dressings and wheels last longer.

Emulsions with *Texaco Soluble Oil D* cool the work quickly, preventing distortion from frictional heat, and they leave the finely finished surface filmed with oil, thus effectively preventing rust.

You'll do more and better work with the help of Texaco Products and Lubrication Engineering Service. Call the nearest of the more than 2500 Texaco distributing plants in the 48 States, or write The Texas Company, 135 East 42nd Street, New York 17, New York.

PREVENT SLUDGE AND RUST IN HYDRAULIC SYSTEMS

Users everywhere report smoother, more dependable hydraulic operation with *Texaco Regal Oils (R & O)*. These turbine-grade oils are specially processed to prevent foaming and contain inhibitors to prevent the rust and sludge formations that cause costly hydraulic stoppages.

TEXACO

TEXACO CUTTING, SOLUBLE AND GRINDING OILS FOR FASTER MACHINING

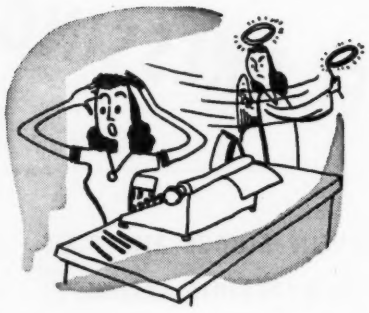
Tune in... TEXACO STAR THEATRE presents the NEW TONY MARTIN SHOW every Sunday night. See newspaper for time and station.

Office Patience is no virtue

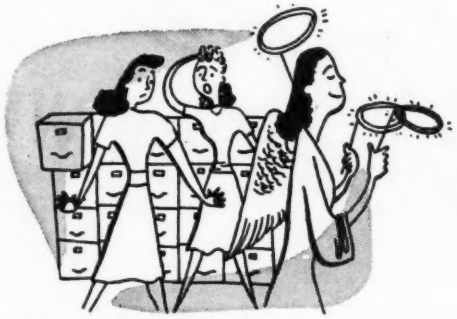
It was as if an atom bomb, instead of an angel, had entered the room.

"I've come to take back your halos," the mad angel said. "I've just learned that Office Patience is no virtue!

"Satan—or some other black sheep—has had the wool over our eyes for too long a time."



It's a sin to type the same sales letter 100 times a day—when you need do it only once. Simply make 99 Ozalid Black-line prints of your original...then add headings, etc. Everyone will think his letter was completely typed. Deception? Yes, but you save 6 hours a day.



Waiting 25 minutes for photocopies or manual transcriptions of file cards and records merits a veto, not a halo. You should use *translucent cards*—and get Ozalid prints in 25 seconds.

Besides, each Ozalid print is a positive (not negative) copy. 100% accurate every time.

Unnecessary posting, checking, repeating add up to the biggest loss of all. Ozalid allows you to make composite reports from separate ledgers . . . to transfer information from one sheet to another in seconds—without lifting a pen. It makes possible dozens of basic short cuts that bring joy—and new accuracy—to every accountant.

Not a vision, but a new Ozalid Streamliner, which you should learn all about today.

In 25 seconds it reproduces anything typed, printed, drawn or photographed on translucent paper. And an 8½ x 11-inch print costs only *one* cent!

All the ways you can save time, labor, and dollars by using it are explained in "The Simplest Business System"—a new, illustrated booklet. Mail this coupon today for a *free* copy.

OZALID *DIVISION OF* DEPT. 85
General Aniline & Film Corporation
Johnson City, New York

Gentlemen: Please send *free* copy of "The Simplest Business System"...and Ozalid prints of typed, drawn, printed, and photographic material.

NAME_____

POSITION_____

COMPANY_____

ADDRESS_____

New Trade Literature

RECENT PUBLICATIONS ON MACHINE SHOP EQUIPMENT, UNIT PARTS, AND MATERIALS

To Obtain Copies, Fill in on Form at Bottom of Page 244 the Identifying Number at End of Descriptive Paragraph, or Write Directly to Manufacturer, Mentioning Catalogue Described in the June, 1947, Number of MACHINERY

Flexible Metal Hose

CHICAGO METAL HOSE CORPORATION, Maywood, Ill. Catalogue G-47, explaining what is termed "flexonics"—the science of controlled bending of thin metal for use under varying conditions of temperature, pressure, vibration, and corrosion—and containing complete data on the various types of flexible metal hose made by the company, including typical applications. Information on stainless-steel bellows is also included. Copies can be obtained if requested on a letter-head, addressed directly to the company.

Electric Salt Bath Furnaces

AJAX ELECTRIC CO., INC., Frankford Ave. at Delaware Ave., Philadelphia 23, Pa. Catalogue 116, describing the operating principle of Ajax-Hultgren electric salt-bath furnaces, and illustrating many different heat-treating applications. Copies can be obtained by metallurgists and metal-working executives if requested on a company letter-head, addressed directly to the Ajax Electric Co.

Hydraulic Machine Tools

ROCKFORD MACHINE TOOL CO., Rockford, Ill. Catalogue 1947, giving complete information on the Rockford "Hy-Draulic" line of machine tool, including planers, shapers, slotters, shaper-planers, and special machines. Copies are available to metal-working production executives if request is sent to company, stating title.

Carbide Blanks

ADAMAS CARBIDE CORPORATION, 1819 Broadway, New York 23, N. Y. Revised catalogue and price list on standard and special carbide blanks; includes data on new standard styles, sizes, and tolerances, as well as standard and special grade designations—their applications and Rockwell hardness. 1

Ball-Bearing Testing Equipment

PHYSICISTS RESEARCH CO., Ann Arbor, Mich. Circular illustrating and describing the Anderometer, an instrument for testing complete ball bearings for deviations of balls and races from true circularity. Bulletin descriptive of an instrument for measuring ball-bearing race waviness and controlling race-grinding machine set-ups. 2

Polishing and Buffing Equipment

DIVINE BROTHERS CO., 200 Seward Ave., Utica 1, N. Y. Bulletin containing a table of recommended wheel speeds (in surface feet per minute and revolutions per minute) for buffing and polishing wheels from 4 to 24 inches in diameter. Circular on Divine "Clothflex" polishing wheels equipped with balancing tubes.....3

Resistance-Welding Controls

WESTINGHOUSE ELECTRIC CORPORATION, P.O. Box 868, Pittsburgh 30, Pa. Booklet B-3839, describing a new line of packaged synchronous-precision, alternating-current resistance welding controls, known as "Synchro-Trol." The complete line of non-synchronous "Weld-O-Timers" is also described. 4

Drilling Machines

CANEDY-OTTO MFG. CO., Chicago Heights, Ill. Catalogue 90, entitled "Enlist in World Progress," containing complete data on the various types of drilling machines, built in single and multiple styles, produced by this company. The line includes floor drills, bench drills, and radial drills.....5

Machine Tool Depreciation

KEARNEY & TRECKER CORPORATION, Milwaukee 14, Wis. Booklet entitled "New Profits through Sensible Depreciation," discussing the factor of obsolescence in figuring depreciation of machine tools, and presenting statistics on the age of machine tools in use in leading industries. 6

Electrolimit Snap Gage

PRATT & WHITNEY DIVISION NILES-BEMENT-POND CO., West Hartford 1, Conn. Bulletin describing the Pratt & Whitney electrolimit snap gage, a portable comparator for checking outside dimensions of parts either in the machine or in the inspection department. 7

Drill Sets and Cabinets

CLEVELAND TWIST DRILL CO., 1242 E. 49th St., Cleveland 14, Ohio. Four bulletins describing drill sets of carbon or high-speed steel supplied in metal cases; fractional-size bit stock drills in plastic containers; and steel cabinets for storing drills. 8

Air-Hydraulic Drill Head

INDUSTRO-MATIC CORPORATION OF AMERICA, 136 W. 52nd St., New York 19, N. Y. Bulletin de-

scriptive of the new Hydromat drill head, an air-hydraulic feed drill head that is designed to increase production on drilling, milling, tapping, and boring operations. 9

Multi-Operation Chucking Machine

HARDINGE BROTHERS, INC., Elmira, N. Y. Bulletin illustrating and describing in detail a new chucking machine for turning, boring, and threading parts up to 6 inches in diameter in one setting. 10

Keyway Broaches

DU MONT CORPORATION, Greenfield, Mass. Catalogue containing complete information, including prices, on "Minute Man" keyway broaches and sets for hand broaching of any size and depth of keyway. Engineering data on keys and keyways is included.....11

Hole-Punching Units

WALES-STRIPPIT CORPORATION, 345 Payne Ave., North Tonawanda, N. Y. Bulletin CJ, illustrating and describing the new Wales Type CJ hole-punching units for punching mild sheet steel, as well as angles and channels, up to 1/4 inch thick. 12

Three-Phase Resistance Welding

SCIAKY BROS., INC., 4915 W. 67th St., Chicago 38, Ill. Bulletin 137-A, entitled "Three-Phase in Resistance Welding Means Balanced Load, High Power Factor, and 75 Per Cent Current Reduction." 13

Free-Machining Steel Plates

JOSEPH T. RYERSON & SON, INC., Chicago 80, Ill. Bulletin illustrating and describing "E-Z-Cut" free-machining and case-hardening steel plates for the production of machine parts, jigs, fixtures, rubber or plastic molds, etc. 14

Hydraulic Pressed Forgings

JOS. DYSON & SONS, INC., 5125 St. Clair Ave., Cleveland 14, Ohio. Folder describing the company's facilities for producing large forged nuts (starting at 3 inches), flat die forgings from 10 to 14,000 pounds, and hydraulic pressed forgings. 15

Accurate Hole Locating

BULLARD CO., Bridgeport 2, Conn. Bulletin entitled "Proved Interchangeability without Jigs," descriptive of the Bullard Man-Au-Trol spacer for the accurate spacing of holes to be drilled, bored, reamed, or tapped. 16

Speed and Feed Selector for Stainless Steel

REPUBLIC STEEL CORPORATION, Cleveland 1, Ohio. Circular slide-rule giving correct cutting speeds and feeds for all common machining operations on eight types of "Enduro" stainless steel. 17

Midget Mills

SEVERANCE TOOL INDUSTRIES, INC., 757 Iowa, Saginaw, Mich. Catalogue 16, giving specifications and application data on Midget mills, deburring tools, countersinking tools, etc. Recommended cutting speeds are included. 18

Tool Engineering Service

BUNELL MACHINE & TOOL CO., 1601 E. 23rd St., Cleveland 14, Ohio. Bulletin 471 (32 pages), describing the facilities of the company for designing special machines and equipment, tools, dies, gages, jigs, etc. Typical products are illustrated. 19

Cleaning Metal Surfaces

OAKITE PRODUCTS, INC., 18 Thames St., New York 6, N. Y. Service Report on the Oakite CrysCoat process for cleaning and rust inhibiting of ferrous metal surfaces in one operation prior to painting. 20

Industrial Lubricants

GULF OIL CORPORATION, 3800 Gulf Bldg., Pittsburgh 30, Pa. Booklet entitled "Better Lubricants for Industry through Research" illustrating the development of improved industrial lubricants. 21

Die Aligning Equipment

LEMPCO PRODUCTS, INC., 5762 Dunham Road, Bedford, Ohio. Catalogue describing Lempco "Di-Ali-Ners" and the method of using them to insure accurate alignment of the die members of a punch press. 22

Totally Enclosed Motors for Machine Tools

WAGNER ELECTRIC CORPORATION, 6400 Plymouth Ave., St. Louis 14, Mo. Bulletin MU-25A, covering totally enclosed motors, of both the fan-cooled and non-ventilated type, for application on machine tools. 23

To Obtain Copies of New Trade Literature

listed in this section (without charge or obligation) fill in below the publications wanted using the identifying number at the end of each descriptive paragraph; detach and mail within three months of the date of this issue (June, 1947) to MACHINERY, 148 Lafayette Street, New York 13, N. Y.

No.	No.	No.	No.	No.	No.	No.	No.	No.	No.

NAME.....POSITION OR TITLE.....

[This service is for those in charge of shop and engineering work in manufacturing plants.]

FIRM.....

BUSINESS ADDRESS.....

CITY.....STATE.....

WIDE RANGE OF STANDARD LOW PRICED CARBOLOY BLANKS AVAILABLE FROM STOCK

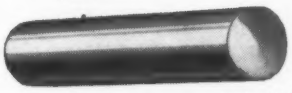
GENERAL PURPOSE CARBOLOY BLANKS

From 60% to 80% of your single point turning, facing, boring jobs can be done with 5 styles of these standards.

SPECIAL PURPOSE CARBOLOY BLANKS

Standard reamer, scraper and lathe center blanks offer maximum economy for these special uses.

SOLID CARBOLOY CYLINDERS (GROUND)



Adaptable to solid boring tools, tool bits and wear resistant uses, a stock of these solid Carboloy cylinders in your tool crib will provide for many uses.

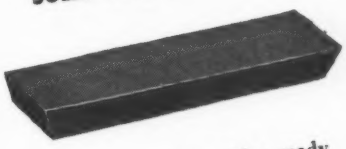
SOLID CARBOLOY ROD (UNGROUND)

Stocked in 15 diameters from 1/64" to 3/8" in random lengths from 4" to 12". Priced as low as 12c per inch. Excellent for wear resistant uses.

CARBOLOY TWIST DRILL TIPS

For economical drilling of cast iron and non-ferrous metals. Priced from 15c up. Wide range of sizes. Immediate deliveries.

SOLID FACE MILL BLADES



Blades ground on three sides ready for use, with clearance angles formed (not ground) on both ends, for either right or left hand cutters.

SOLID GROUND BALLS

For long economical life on sizing and burnishing operations. Also used in check valves. Sizes 1/8" to 1".

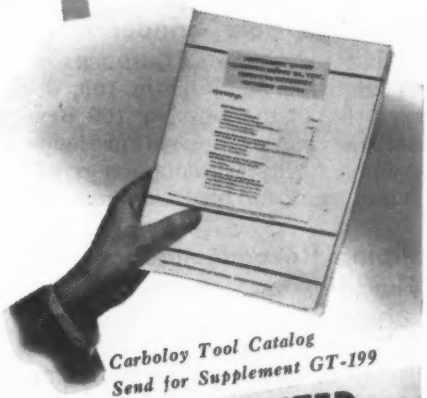
SOLID GUIDE RINGS

For use as a guide for textiles, wire, and similar wear-resistant applications. Now widely used on better fish rods.

BLANKS FOR THREADING TOOLS

Stocked for use in tool sizes 3/16", 1/2", 5/8", 3/4". Priced 26c to $1.00. Standard in Grade 78B.

Low priced standard Carboloy Blanks are available to you not only for lathe-tool use but also to cover diversified range of other cutting and non-cutting applications, as illustrated above. Prices and specifications of recently announced new blanks, as well as revised prices and specifications on a number of previously established standards, are contained in our recently published catalog supplement GT-199. Copies gladly mailed upon request. Carboloy Company, Inc., 11107 E. 8 Mile Ave., Detroit 32, Michigan.



Carboloy Tool Catalog
Send for Supplement GT-199

Standards are stocked in 74 cities coast-to-coast

CARBOLOY (REG. U.S. PAT OFF.) **CEMENTED CARBIDES**

Clutches and Couplings

HILLIARD CORPORATION, 115 W. 4th St., Elmira, N. Y. Technical bulletin 231, describing the construction and operating characteristics of the Hilliard over-running clutch and coupling; includes complete installation data. 24

Gears

EARLE GEAR & MACHINE CO., 4709 Stenton Ave., Philadelphia 44, Pa. Catalogue covering the complete line of Earle gears and special machinery. Includes information on ordering and a section of gear formulas. 25

Welding of Dies

AMPCO METAL, INC., 1745 S. 38th St., Milwaukee 4, Wis. Procedure Sheets 2325 and 2326, containing complete instructions for repairing aluminum-bronze dies by welding and for the arc-welding of composite dies. 26

Speed Selector

B. F. GOODRICH CO., Akron, Ohio. Circular describing the principle of operation of the new Goodrich variable-V-planetary infinite-ratio speed selector, which provides any speeds from 0 to 800 R.P.M. at constant torque. 27

Bench Lathes and Milling Machine

WELCH MACHINE TOOL CO., 411 E. Third St., Muncie, Ind. Bulletins describing Welch bench lathes and attachments, and a small horizontal milling machine and attachments. 28

Precision Hole Grinder

BRYANT CHUCKING GRINDER CO., Springfield, Vt. Bulletin 109, descriptive of the new No. 109 Bryant automatic internal precision grinder for high-production grinding of small and medium bores...29

Piping Recommendations for Fluid-Power Systems

OILGEAR CO., 1312 W. Bruce St., Milwaukee 4, Wis. Bulletin 90011, giving installation information on piping for Oilgear fluid-power systems. 30

Stainless-Steel Tubing

BABCOCK & WILCOX TUBE CO., 85 Liberty St., New York 6, N. Y. Bulletin TB-323, describing properties and applications of stainless-steel tubing. 31

Hydraulic Testing Machine

BALDWIN LOCOMOTIVE WORKS, Philadelphia 42, Pa. Bulletin 182, describing in detail the Sonntag Model S-10 universal hydraulic testing machine, designed for mass production testing. 32

Welded-Steel Presses

WARREN CITY MFG. CO., Griswold St., Warren, Ohio. Series of booklets describing in detail the features and construction of a complete line of welded-steel presses and press brakes. 33

Open-Side Planers

G. A. GRAY CO., 3611 Woodburn Ave., Cincinnati 7, Ohio. Bulletin 55, containing complete details on the new Gray open-side "Planer Cub," made in 24-, 30-, and 36-inch sizes. 34

Norbide Plug Gages

AMERICAN GAGE MACHINE CO., SIZE CONTROL DIVISION, 2500 Washington Blvd., Chicago 12, Ill. Catalogue 47, describing Norbide reversible plug gages and other precision products. 35

Industrial Washing Machines

MABOR CO., INC., Walnut St., Rahway, N. J. Circular covering the company's line of parts washing and degreasing machines, including conveyorized types for production work. 36

Metal Spray Gun

METALOY SPRAYER CO., 135 Liberty St., New York 6, N. Y. Leaflet on a metal spray gun for intermittent or production spraying of alloys that melt at from 100 to 600 degrees F. 37

Pneumatic Tools

SKILSAW, INC., 5033 Elston Ave., Chicago 30, Ill. Circular illustrating the new line of pneumatic drills, hammers, nut-runners, and grinders made by the company. 38

High-Speed Surface Grinder Attachment

D. & S. MODEL CO., Ludington, Mich. Leaflet describing the construction of the Blitzrev high-speed surface grinder attachment. 39

Abrasives

CLOVER MFG. CO., Norwalk, Conn. General catalogue covering the complete line of abrasives made by this company. Technical information is included. 40

Double Helical Gears

WORTHINGTON PUMP & MACHINERY CORPORATION, Harrison, N. J. Circular 1958-A, on double helical reduction gears for steam turbine drives. 41

Chain Pipe Tools

J. H. WILLIAMS & CO., 400 Vulcan St., Buffalo 7, N. Y. Booklet on chain pipe tongs, vises, and stands, including specifications and prices. 42

Lifting Magnets

OHIO ELECTRIC MFG. CO., 5900 Maurice Ave., Cleveland 4, Ohio. Catalogue on construction features and applications of lifting magnets and controllers. 43

Portable Power Saw

NORDBERG MFG. CO., Milwaukee 7, Wis. Bulletin 132, outlining the uses and advantages of the new Nordberg-Buday portable power saw. 44

Industrial Uses of Nylon

POLYMER CORPORATION, Reading, Pa. Circular describing the physical properties and potential industrial uses of molded and machined nylon. 45

Sheet-Metal Welding

AIR REDUCTION SALES CO., 60 E. 42nd St., New York 17, N. Y. Bulletin ADR-42, on jigs and fixtures for sheet-metal welding...46

Lay-Out Fluid

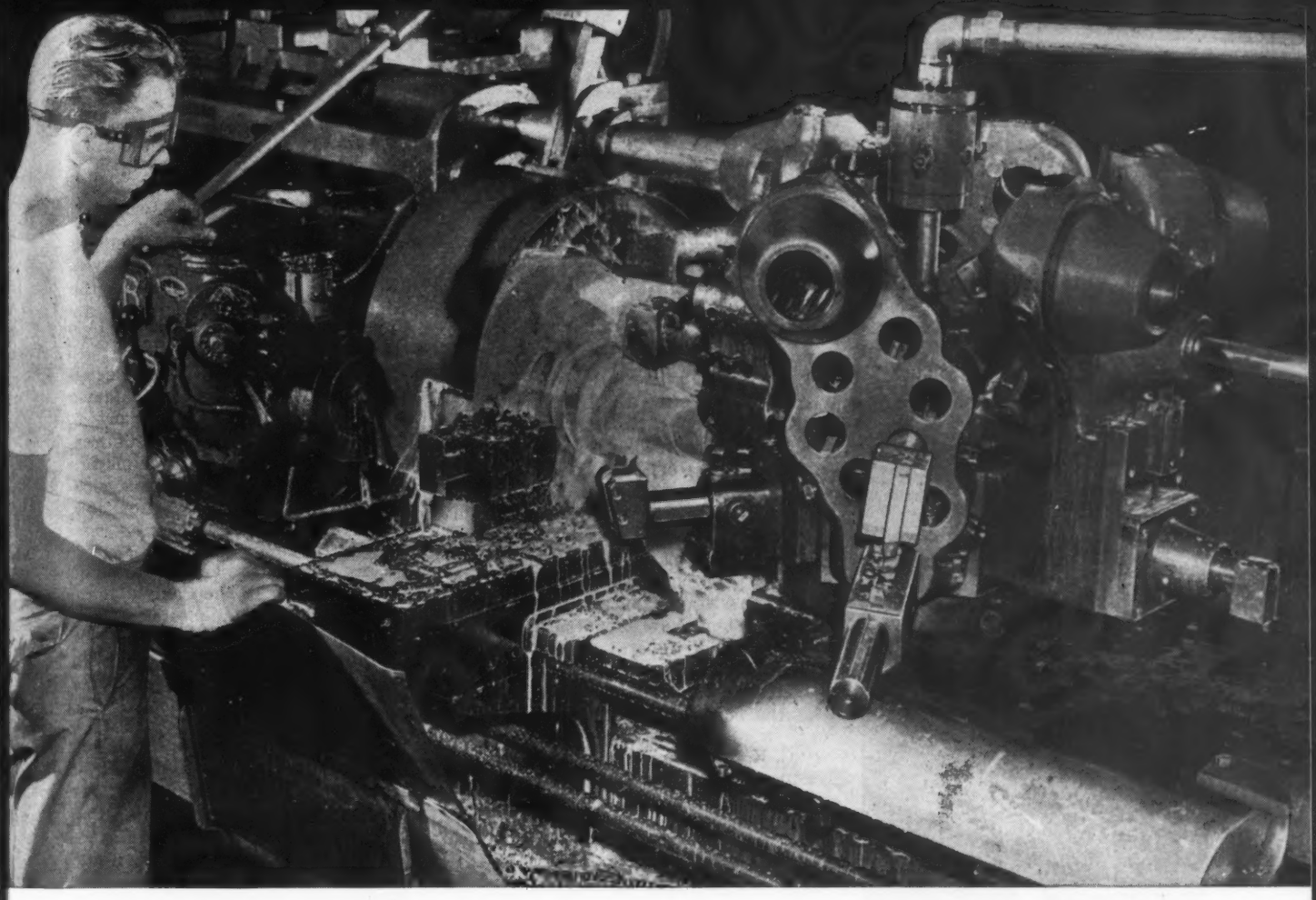
DAYTON ROGERS MFG. CO., Minneapolis, Minn. Circular announcing a new fluid for lay-out work on tools, dies, jigs, etc. 47

Protective Coatings

PRUFCOAT LABORATORIES, INC., 63 Main St., Cambridge 42, Mass. Circular on "Prufcoat" protective coatings and their application...48

Heavy-Duty Arbors

PAXSON CO., Dowagiac, Mich. Circular descriptive of "Bearcat Lifelong" arbors for a variety of heavy-duty applications. 49



How this FASTERMATIC combined two jobs in one chucking!

Here, on a clutch sleeve, the Fastermatic eliminated an extra chucking and machining operation by the simple addition of a standard automatic recess boring attachment. The work, which previously required two machines and two operators, is now done complete in *one* Fastermatic operation. More concentric diameters are produced through a *single* chucking—and production is increased.

In case after case, the versatility of the Fastermatic together with the tooling "know-how" of Gisholt engineers have made it possible to handle more work with standard tools and attachments, and do it on a cost-cutting basis.

Why not see for yourself what Gisholt's combination of EXPERIENCE and the RIGHT MACHINE can do for you?

GISHOLT MACHINE COMPANY

1209 East Washington Avenue MADISON 3, WISCONSIN

THE GISHOLT ROUND TABLE *represents the collective experience of leading specialists to help you solve your problems in the machining, surface finishing and balancing of round and semi-round parts. Ask Gisholt for help on your problems.*

TURRET LATHES • AUTOMATIC LATHES • BALANCERS • SUPERFINISHERS • SPECIAL MACHINES

News of the Industry

California

GLYNN WILLIAMS has been appointed chief engineer of the Axelson Mfg. Co., 6160 S. Boyle Ave., Los Angeles, Calif., to succeed E. W. OSTROM, who has resigned. Mr. Williams, who has been with the organization since 1934, was previously divisional head of aircraft engineering.

Glynn Williams, Chief Engineer of the Axelson Mfg. Co.

FRANK KANE, formerly MACHINERY'S subscription field representative for Michigan, has been placed in charge of subscription sales for all the Pacific and Mountain States. He succeeds H. A. JOHNSON, who retired last fall on account of ill health. Mr. Johnson had served MACHINERY in the western territory since 1927. Mr. Kane's headquarters are in South Pasadena, Calif.

CHARLES V. COLE has been named works manager of the National Motor Bearing Co., Inc., Redwood City, Calif. Prior to assuming this post he was a management consultant to numerous concerns operating in the San Francisco Bay area.

CARPENTER STEEL Co., Reading, Pa., has opened a new Los Angeles warehouse and office at 1939 E. 16th St. D. J. O'NEIL has been appointed Pacific Coast manager, in charge of the new Los Angeles warehouse.

R. W. KERR, formerly vice-president and treasurer of the Plomb Tool Co., Los Angeles, Calif., has been made executive vice-president.

Connecticut and Massachusetts

FREDERICK G. HUGHES, vice-president of General Motors Corporation and general manager of the New Departure Division at Bristol, Conn., has retired after thirty-six years of association with New Departure. He will be succeeded as general manager by MILTON L. GEARING, who has been plant manager for New Departure at Meriden, Conn., for fifteen years. Mr. Hughes became connected with New Departure in 1911 in the capacity of chief engineer, and was made assistant general manager in 1914. When New Departure became a division of General Motors in 1933, Mr. Hughes was named general manager, and was elected a vice-president of the corporation last January.

O. K. TOOL Co., INC., Shelton, Conn., announces the opening of a district office at Chicago, Ill., under the supervision of DAVID BRISTOL. Mr. Bristol was previously chief tool designer of the company. EUGENE SCOVIL will be sales representative for southern Chicago and northern Indiana, and FRANK GAYNOR will be representative for Iowa and southern Illinois. The company also announces the appointment of the RICKERT INDUSTRIAL SUPPLY Co., Milwaukee, Wis., and MARTIN & PRESTEGAARD Co., Minneapolis, Minn., as distributors.

WHITON MACHINE Co., 190 Howard St., New London, Conn., has just been organized to take over the business of D. E. WHITON MACHINE Co., of New London, manufacturer of automatic gear-cutting machines, centering machines, lathe chucks, and steam-turbine engines. LUCIUS E. WHITON, son of the founder of the original company, is chairman of the board of directors of the new company, and GEORGE A. HIGHBERG, for the last ten years vice-president and factory manager of the Cushman Chuck Co., Hartford, Conn., is president.

JOHN J. BORRUP has retired from the Pratt & Whitney Aircraft Division of the United Aircraft Corporation, East Hartford, Conn. Mr. Borrup was one of the Pratt & Whitney Aircraft pioneers, starting in 1925 with the original company. He served as the first superintendent and later held the posts of factory manager and production manager.

FRANK O. HOAGLAND, vice-president of Pratt & Whitney Division Niles-Bement-Pond Co., West Hartford, Conn., has been elected vice-chairman of the Mechanical Standards Committee of the American Standards Association. Mr. Hoagland represents the National Machine Tool Builders' Association on the committee.

HENRY G. EMT has been elected president and treasurer of the James Coulter Machine Co., Bridgeport 5, Conn., to succeed JAMES COULTER, who recently resigned. Other officers elected are EDWIN W. THORNTON, vice-president, and ROYAL K. THORNTON, who was re-elected secretary.

FRANK R. SIMON has been made general manager of the Carlyle Johnson Machine Co., Manchester, Conn., succeeding SCOTT H. SIMON, who has held the post since 1905. Frank R. Simon will continue to serve also as assistant to the president.

D. K. MACLEAN has been appointed export manager for all the lines of machinery manufactured at the four plants of Farrel-Birmingham Co., Inc. He will make his headquarters at the main office in Ansonia, Conn.

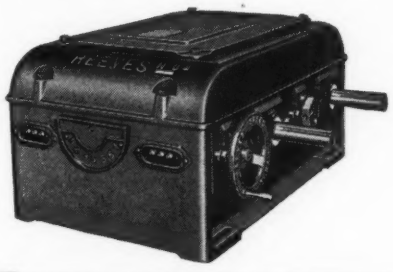
CONNECTICUT PRECISION CASTING Co. has been organized at New Canaan, Conn., by C. T. FINN and B. T. BUTTERWORTH, JR., for producing small intricate castings to close tolerances.

STUART E. SINCLAIR has been named chief metallurgist of the Greenfield Tap & Die Corporation, Greenfield, Mass. Prior to his present appointment, he had been, since 1936, metal-

Stuart E. Sinclair, Recently Appointed Chief Metallurgist, Greenfield Tap & Die Corp'n

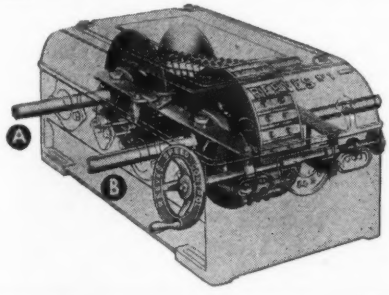
Reeves Variable Speed Transmission

"SO SIMPLE YOU DON'T HAVE TO BE AN EXPERT TO MAINTAIN 'EM"



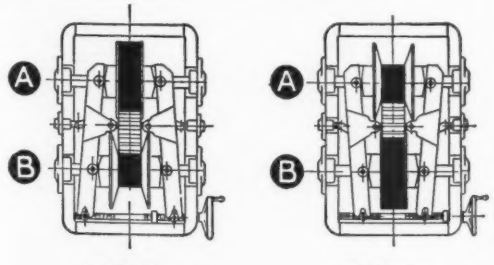
What it is—

Modern, compact, rugged unit which provides accurate, stepless, variable speed control for industrial machines. May be mounted in any position—on floor, ceiling, wall, platform or on driven machine. Available in sizes from fractional to 87 hp. and in a wide range of speed variation from 2:1 to 16:1 inclusive. Horizontal and vertical types in open and enclosed designs. Easy to lubricate through force-feed fittings. Speed shifting may be accomplished by manual (handwheel), electric remote (push button) or completely automatic controls. Universally adjustable motor bases for individual motor drive.



What it does—

The degree of speed regulation provided by the REEVES Transmission is infinite between predetermined limits. Any change of speed—even to smallest fraction of an rpm—is instantly available, and, once secured, may be accurately maintained as long as required. Entire speed range is covered smoothly without steps or jumps and while driven machine is in operation. Speeds may be changed without interrupting production, as required by different materials, shapes, sizes, operator skills, changing diameters in winding and cutting processes, etc. Results: production is faster and of uniformly higher quality.



At Maximum At Minimum

How it works—

Design is based on simple, time-tested principle of a V-belt driving between two pairs of adjustable cone-shaped discs, mounted on parallel shafts. One shaft (A) receives power at constant speed from motor, lineshaft, etc. The other shaft (B) connected to driven machine transmits power at infinitely adjustable speeds above and below speed of constant speed shaft as V-belt assumes different diameters of contact against each set of discs. Note positions of discs and speed changing levers at minimum speed setting and how these positions are reversed at maximum. Number of in-between speeds is infinite.

REEVES PULLEY COMPANY • COLUMBUS, INDIANA

Standardly Furnished on Many Leading Makes of Machines

Accurate Variable

REEVES Speed Control

Gives the Right Speed for Every Job!

lurgist for the Geometric Tool Co., a division of the Greenfield Tap & Die Corporation.

NORTON Co., Worcester, Mass., recently broke ground for the construction of a new factory at Greendale, which will be devoted specifically to the manufacture of vitrified grinding wheels. The new plant will be 602 feet long by 320 feet wide, and will afford 192,640 square feet of working space. It is hoped that the plant will be completed and in operation by July, 1948. Several other new buildings are also under construction.

Illinois and Indiana

PAUL R. FIELDS has recently been appointed purchasing agent for Danly Machine Specialties, Inc., 2100 S. 52nd Ave., Chicago 50, Ill. He was previously employed by the F. L. Jacobs Co., Detroit, Mich., in the capacity of assistant to the vice-president in charge of manufacturing.

GENERAL ELECTRIC Co., Pittsfield, Mass., announces that it has recently purchased a factory at Decatur, Ill., from the War Assets Administration, which will be used for the manufacture of plastics molded parts. It is expected when full production is attained, that the new factory will employ 500 persons.

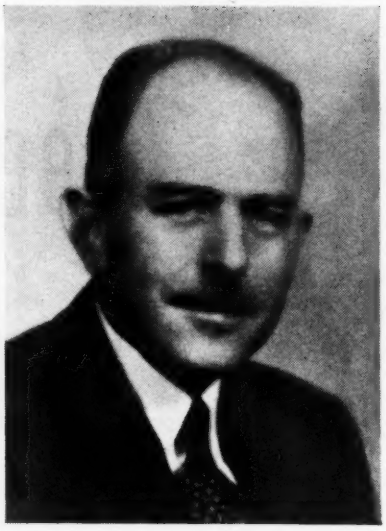
AMGEARS, INC., Chicago, Ill., manufacturers of precision and production gears, have announced the appointment of the following representatives: GEORGE T. WRIGHT, 19859 Beach Cliff Blvd., Cleveland, Ohio; R. E. PARRY & Co., INC., Buffalo, N. Y.; and H. C. HOOK Co., INC., Worcester, Mass.

SKILSAW, INC., 5033 Elston Ave., Chicago 30, Ill., has announced its entrance into the pneumatic tool field with a new line of twenty-eight models, including hammers, drills, screwdrivers, nut-runners, and die-grinders. All the pneumatic tools will be produced in Aurora, Ill.

VASCOLOY-RAMET CORPORATION, North Chicago, Ill., has announced increased sales and service representation in the following areas: B. J. NADEN in Cleveland, J. M. KINNEY in Toledo, FRANK SCHEFFLER in Kansas City, and DEAN R. CLINE in Chicago.

OLAF HAUG has been appointed automotive representative in continental Europe and Scandinavia for the Borg-Warner Corporation, 310 S. Michigan Ave., Chicago 4, Ill. Mr. Haug's headquarters will be in Oslo, Norway.

TUBE TURNS, INC., Louisville, Ky., announces the removal of the Chicago offices to larger quarters at 600 S. Michigan Ave.



John H. Matthews, Vice-president in Charge of Manhattan Rubber Division, Raybestos-Manhattan, Inc.

J. C. THOMPSON has been appointed chief process engineer of the Hagerstown, Ind., plant of the Perfect Circle Corporation, and A. F. KNOSE has been made master mechanic of the newly created mechanical department of the plant.

Michigan

R. M. LINDGREN, formerly chief engineer of Lincoln Park Industries, Detroit, Mich., has joined the Metal Carbides Corporation, Youngstown, Ohio, in the capacity of sales engineer. PAUL E. DIMLING, previously with the Firth-Sterling Steel Co., has also become a sales engineer of the company. Both men will have their headquarters at 6432 Cass Ave., Detroit 2, Mich.

D. S. HARDER has been appointed director of manufacturing of the Ford Motor Co., Dearborn, Mich., and M. L. BRICKER has been designated director of general production. ROSCOE M. SMITH will head the newly created Parts and Equipment Manufacturing Division. Both Mr. Harder and Mr. Bricker are vice-presidents of the company.

TAYLOR-THOMPSON MACHINERY CO., 8095 Livernois Ave., Detroit 4, Mich., has recently been organized to serve as a dealer in machinery, including machine tools, resistance welders, die-casting machines, and special machines. The concern is representing a number of manufacturers in these lines.

MICROMATIC HONE CORPORATION is erecting a 35,000 square foot addition to its present plant at 8100 Schoolcraft, Detroit, Mich., to provide space for the production of its new line of honing machine tool equipment.

RUTLAND TOOL SERVICE, 13006 Greeley Ave., Detroit 3, Mich., announces the opening of a new department for the salvaging of tungsten-carbide tipped cutters.

A. E. HILL has been appointed plant superintendent of Gar Wood Industries, Inc., Wayne, Mich., succeeding the late H. T. Kvindlog.

Minnesota and Wisconsin

W. T. FINK, president of Form Products Co., Inc., Minneapolis, Minn., has been appointed distributor of the Vascoloy-Ramet Corporation in the Minnesota area.

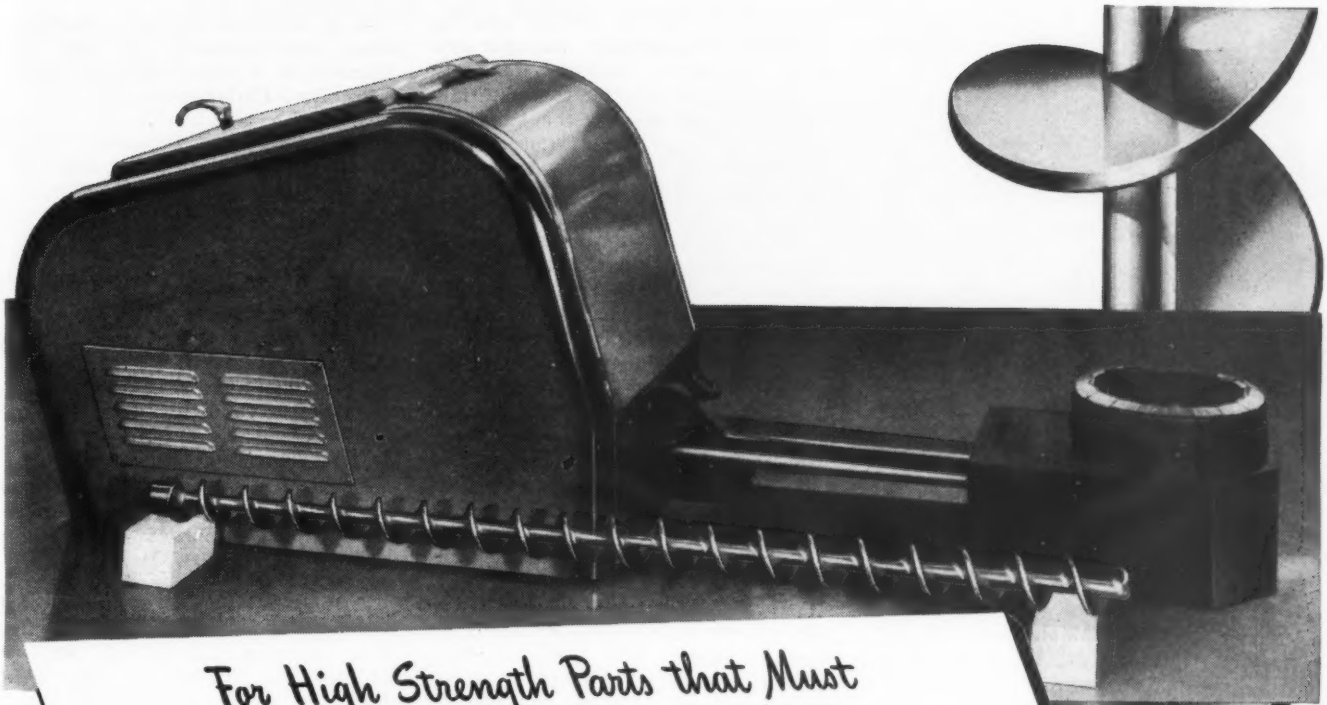
ALEXANDER GABAY has resigned as president and general manager of the Helwig Mfg. Co., Inc., St. Paul, Minn.

JOHN C. FITZPATRICK Co., Toronto 1, Ontario, Canada, has been appointed sales agent for AMPCO METAL, INC., Milwaukee 4, Wis., in the province of Ontario, and the ANSTICE Co., Rochester, N. Y., has been appointed agent for the company in western New York.

New Jersey

RAYBESTOS-MANHATTAN, INC., Passaic, N. J., announces that, at a recent meeting of the board of directors, JOHN H. MATTHEWS was elected vice-president in charge of the Manhattan Rubber Division, and O. H. CILLEY, assistant general manager of the

O. H. Cilley, Newly Elected Vice-president of Raybestos-Manhattan, Inc.



For High Strength Parts that Must Resist Corrosion and Abrasion, Use...

J&L OTISCOLOY HIGH TENSILE STEEL

For stoker flights and other machine parts that must resist corrosion and abrasion to give satisfactory service many manufacturers are standardizing on J&L Otiscoloy steel. They find that it welds readily yet retains its extra strength without special heat treatment. Parts made of Otiscoloy wear longer, reduce replacement and maintenance costs, make for satisfied customers. Write for Otiscoloy booklet today.

JONES & LAUGHLIN STEEL CORPORATION

PITTSBURGH 30, PENNSYLVANIA

J&L STEEL

A. F. Heinsohn, New Member of the Board of Directors Raybestos-Manhattan, Inc.

United States Asbestos Division, was made a vice-president of the corporation. A. F. HEINSOHN, general manager of the General Asbestos and Rubber Division, was made a member of the board of directors.

HENRY S. ELDER has been named vice-president of Titeflex, Inc., Newark, N. J., manufacturer of flexible tubing, industrial filters, and ignition shielding. It has recently been announced by the company that the export department, which is being expanded, is now located at the main offices in Newark.

New York

SAMUEL KOFFSKY, chief engineer of the Simmons Machine Tool Corporation, Albany, N. Y., recently spoke before the senior class of mechanical engineers at Rensselaer Polytechnic Institute, Troy, N. Y., on the subject of pre-employment indoctrination. In the course of his talk, he outlined the qualifications that a chief engineer looks for in a graduate starting his career. Mr. Koffsky was graduated from the institute in the class of 1923.

CARBORUNDUM CO., Niagara Falls, N. Y., announces the appointment of CLARENCE E. HAWKE as director of domestic sales; EDWIN B. FORSE as manager of the Refractories Division at Perth Amboy; BOYD H. JOHNSON as manager of refractories sales at Perth Amboy; and RUSSELL G. ALBERTSON as division manager of the Canadian Carborundum Co., Ltd., Niagara Falls, Ontario, Canada.

SY-CO CORPORATION, 1182 Broadway, New York 1, N. Y., is a new industrial construction consultant company specializing in the design and installation of automatic conveyor systems. GUSTAV A. SYVERSEN, formerly in charge of design for the materials handling department of the American Gas & Electric Service Corporation of New York, has been appointed consultant.

EDWIN E. POTTER has been elected vice-president of the General Electric Co., Schenectady, N. Y., in charge of the commercial aspects of the company's relations with customers, succeeding vice-president EARL O. SHREVE, who continues as a member of the president's staff with special duties. Mr. Potter's headquarters will be at 570 Lexington Ave., New York City.

AIR REDUCTION SALES CO., 60 E. 42nd St., New York 17, N. Y., announces the appointment of the following district managers: L. A. HAMILTON, Seattle, Wash., district; EMMETT W. MACCORKLE, JR., Portland, Ore., district; and HERMAN VAN FLEET, JR., New England district, with headquarters at 122 Mt. Vernon St., Boston, Mass.

HERBERT C. GUTERMAN, senior vice-president and general manager of the Arma Corporation, Brooklyn, N. Y., was elected president of the corporation at the annual meeting of the board to succeed ARTHUR P. DAVIS. During the war, he headed the Electronics Components Group, Production Division, Bureau of Aeronautics.

WAYNE TOOL CO., Waynesboro, Pa., manufacturer of reamers and rivet sets, has appointed the NATIONAL HARDWARE & EQUIPMENT CO., Empire State Bldg., New York 1, N. Y., distributor for the company in the New England states and in New York and New Jersey.

E. A. ERICKSON has been appointed shop superintendent at the new Hornell, N. Y., plant of S K F Industries, Inc., Philadelphia, Pa.

J. ROBERT FISGUS, formerly with the Cincinnati Planer Co., has joined the sales force of the George Keller Machinery Co., Buffalo, N. Y.

Ohio

BUNELL MACHINE & TOOL CO., Cleveland, Ohio, builder of special machines and tooling, announces the appointment of the following district representatives: STATE MACHINE TOOL CO., 1441 N. Third St., Milwaukee, Wis.; HERBERT K. BAKER, 3020 E. Grand Blvd., Detroit, Mich.; and TRIPLEX MACHINE TOOL CORPORATION, 125 Barclay St., New York 7, N. Y.

J. HERBERT MYERS has been elected vice-president in charge of Machine Tool Division sales of the Lodge & Shipley Co., Cincinnati, Ohio, and HARRY J. BUETTINGER, secretary and treasurer. Mr. Myers previously served as secretary and Mr. Buettinger as treasurer.

R. H. DAISLEY has been elected vice-president and director of manufacturing of the Eaton Mfg. Co., Cleveland, Ohio, and H. J. MCGINN vice-president and director of sales.

CINCINNATI MILLING AND GRINDING MACHINES, INC., sales subsidiary of the CINCINNATI MILLING MACHINE CO., Cincinnati, O., announces the election of the following officers: FREDERICK V. GEIER, president; WALTER W. TANGEMAN, SWAN E. BERGSTROM, and NELSON F. CALDWELL, vice-presidents; FERRIS M. ANGEVIN, treasurer; and MILLARD ROMAINE, secretary.

Shelburne Studios

(Left) Swan E. Bergstrom and (Right) Nelson F. Caldwell, Recently Elected Vice-presidents of Cincinnati Milling and Grinding Machines, Inc.

Welded Steel Cuts Cost 27%

By C. D. Bonifield
Vice-President in Charge of Production
The Globe Company, Chicago, Ill.

IN our development program of continually improving the designs and production of our machinery for the meat packing industry, we have found it helpful to think in terms of arc welded steel construction. This affords a highly flexible approach to our problems and the end result is beneficial to the users of our products, the welded designs being strong, rigid, light-weight and of smooth, sanitary surfaces.

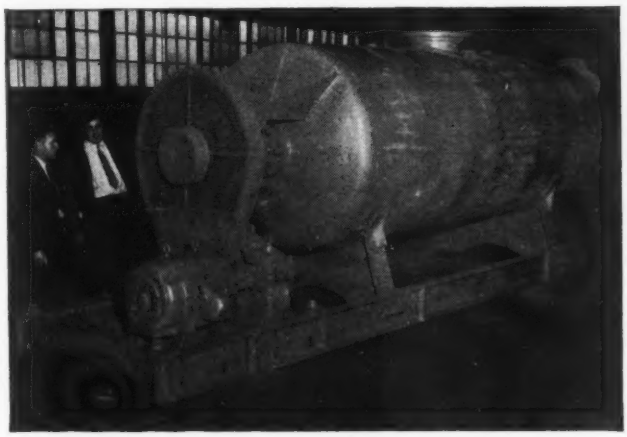


Fig. 1. Dry rendering cooker of welded construction.

One design which has been changed recently to welded steel construction is the saddle for the dry rendering cooker shown in Fig. 1. Two of these saddles support the welded pressure vessel on the welded base of this machine.

Fig. 2. Saddle support member of former design.

Fig. 3. Welded steel saddle costs 27% less than former design.

Fig. 4. Fixture used for assembly of welded saddle.

A saddle of former construction is shown in Fig. 2. The welded steel saddle, shown in Fig. 3, is produced at a total saving of 27% in cost over the former design.

The welded saddle, 60″ wide, 24″ high and 8″ deep, is fabricated from ½″ mild steel plate, consisting of four pieces, flame-cut and brake formed. The parts are assembled in the welded fixture shown in Fig. 4, which is placed on a work table in the flat position. After tack welding the parts together, the assembly is removed from the fixture and finish welded as shown in Fig. 5, with the saddle positioned for downhand welding of all joints. This requires continuous, two-pass fillets on both sides to join the flange to the web. The end pieces of the flange are butt-welded on both sides to the top flange assembly.

Fig. 5. Joints are positioned for downhand welding.

In approaching designing problems, our engineers have been aided by the Studies in Machine Design published by Lincoln Electric. These can be secured by writing to THE LINCOLN ELECTRIC COMPANY, Dept 225, Cleveland 1, Ohio.

Advertisement

Carl F. Roby, Newly Elected Vice-president of Cincinnati Milling Machine Co.

CARL F. ROBY, who from 1934 to 1946 was managing director of Cincinnati Milling Machines Ltd., Birmingham, England, a subsidiary of the Cincinnati Milling Machine Co., Cincinnati, Ohio, was elected a vice-president of the latter company at a meeting of the board of directors.

WILLIAM F. LONGFIELD has joined the Warren City Mfg. Co., Warren, Ohio, manufacturer of Warco mechanical and hydraulic presses and press brakes, in the capacity of chief sales engineer. Mr. Longfield was previously associated for thirty-five years with the Cleveland Punch & Shear Works Co., the last ten years of which he served as chief engineer.

William F. Longfield, Newly Appointed Chief Sales Engineer, Warren City Mfg. Co.

JOHN J. PROHASKA, general sales manager of the Cleveland Automatic Machine Co., Cincinnati, Ohio, was elected vice-president of the company at a recent meeting of the board of directors. Also elected vice-presidents were NICHOLAS PEAY, former assistant to the president, and RICHARD E. LEBLOND, president of the R. K. LeBlond Machine Tool Co., who was also elected a director.

DAVID M. HALLIER, sales manager of the National Tool Co., Cleveland, Ohio, has been made vice-president. He was formerly associated with the Standard Tool Co.

Pennsylvania and Maryland

JACOB S. DISSTON, JR., has been elected president of Henry Disston & Sons, Inc., Philadelphia, Pa. Mr. Disston, vice-president for fourteen years, succeeds S. HORACE DISSTON, who has become chairman of the board. WALTER H. GEBHART, first vice-president of Henry Disston & Sons, has been elected president of the American Supply & Machinery Manufacturers' Association.

JAMES B. JAMISON has been named president of the Standard Steel Specialty Co., Beaver Falls, Pa., to succeed the late Ernest J. Wagner. Mr. Jamison has been with the company since its organization on December 1, 1925, first as secretary and sales manager, and later as vice-president and director of sales.

BRIGADIER GENERAL HUGH C. MINTON, director of the Production Division of the Army Service Forces during the war, will become production manager of Koppers Co., Inc., Pittsburgh, Pa., on July 1, reporting to General Brehon Somervell, president of the company.

L. C. GRIMSHAW has been appointed metallurgical engineer of the Clad Products Division of the Jessop Steel Co., Washington, Pa. Prior to joining the Jessop Steel Co., he was with the Latrobe Electric Steel Co.

ROY C. MCKENNA, president and chairman of the board of the Vanadium Alloys Steel Co., Latrobe, Pa., has been elected president of the Pennsylvania State Chamber of Commerce. Mr. McKenna has been a

Roy C. McKenna, New President of the Pennsylvania State Chamber of Commerce

David M. Hallier, New Vice-president of the National Tool Co.

director of the Chamber of Commerce since 1928. He is also serving industry as chairman of the Western Pennsylvania Committee for Economic Development and first vice-president of the American Tariff League.

READING CHAIN & BLOCK CORPORATION, Reading, Pa., has appointed YARRINGTON & JOHNS, INC., 320-23 W. 24th St., Baltimore, Md., representative of the corporation's line of cranes and hoists in the states of Delaware and Maryland and the cities of York and Lancaster, Pa.

DR. STEPHEN J. ZAND has been appointed vice-president in charge of engineering of the Lord Mfg. Co., Erie, Pa. He has been working with the company as consulting vibration engineer since 1933, and from now on will devote his full time to engineering, research, and development activities in the company's Product Engineering and Research Divisions.

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M-11, Detroit Tap and Tool Company's exclusive chrome-cobalt HSS for threading tools is now standard also for all Detroit thread plug gages. This applies to both standard and special gages.

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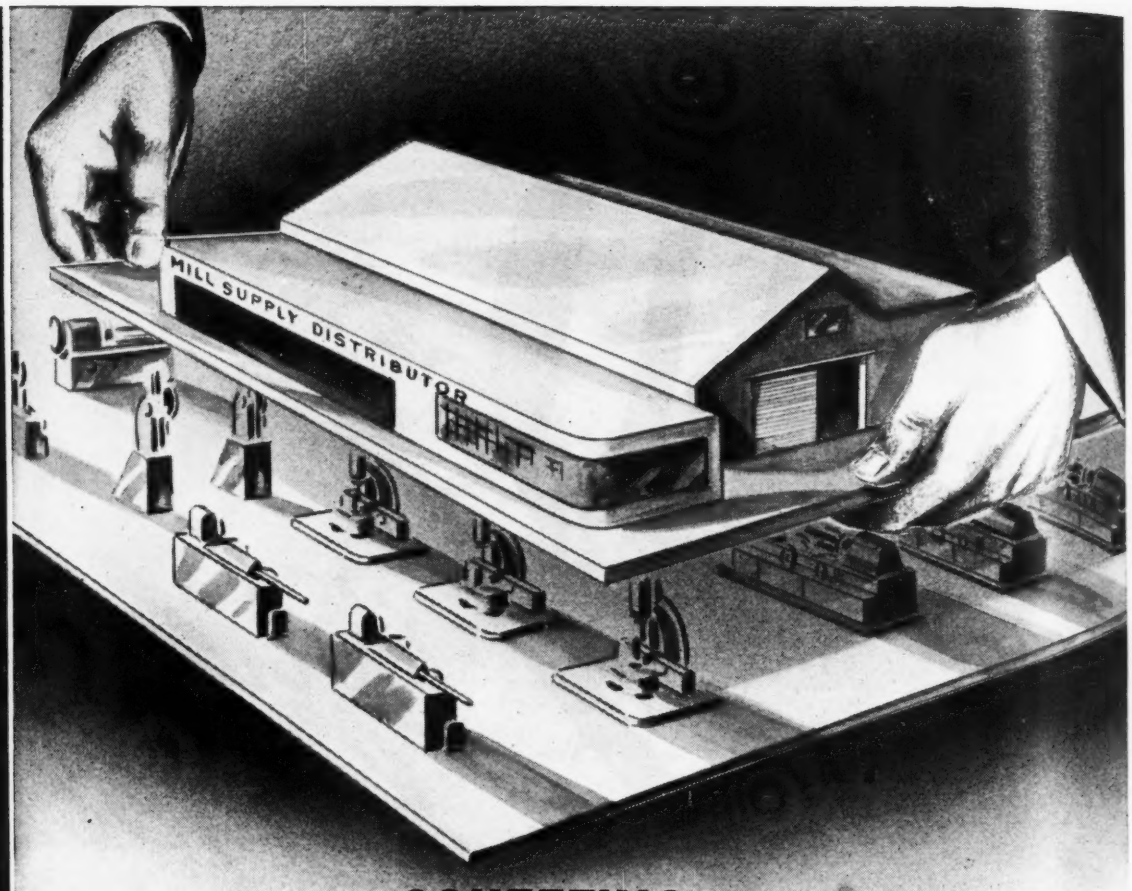

IMAGINE SQUEEZING HIS SET UP INTO YOUR PLANT LAYOUT

Your mill supply distributor's complete stock of tools, materials and equipment is almost as close to you as your own tool cribs and stockrooms. Yet his service adds not one penny to your overhead nor does it steal one inch of productive space. As an expert in supply and procurement specializing in the things you need and use, your mill supply distributor makes a valuable contribution to the well-ordered conduct of your business. He is worth cultivating.

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HACKSAWS • BAND SAWS FOR CUTTING METAL, WOOD, PLASTICS

MACHINERY'S DATA SHEETS 587 and 588

THRUST, IN POUNDS, REQUIRED FOR DRILLING—1

Drill Size	Feed, in Inches per Revolution									
	0.001	0.005	0.010	0.015	0.020	0.001	0.005	0.010	0.015	0.020
	Cast Iron					Machine Steel				
1/16	20	74	128	177	223	42	128	207	274	335
3/32	27	98	170	235	296	55	170	275	364	445
1/8	33	120	208	288	362	68	207	336	445	544
3/16	44	159	276	382	481	90	275	446	591	723
1/4	54	194	338	467	588	110	337	546	723	884
5/16	63	227	395	546	688	128	394	638	846	1035
3/8	71	258	449	621	781	146	447	725	961	1175
7/16	79	287	500	692	871	163	498	807	1070	1310
1/2	87	315	549	759	956	179	547	886	1175	1435
9/16	95	342	596	825	1040	194	594	962	1275	1560
5/8	102	369	642	888	1115	209	640	1035	1375	1680
11/16	109	394	686	949	1195	223	684	1105	1470	1795
3/4	116	419	729	1010	1270	237	727	1175	1560	1905
13/16	122	443	771	1065	1340	251	768	1245	1650	2015
7/8	129	467	812	1125	1415	264	809	1310	1740	2125
15/16	135	490	852	1180	1485	277	849	1375	1825	2230
1	141	512	892	1235	1550	290	889	1440	1910	2330
1 1/8	154	556	968	1340	1685	315	965	1565	2075	2535
1 1/4	165	599	1040	1440	1815	339	1040	1685	2230	2725
1 3/8	178	640	1115	1540	1940	362	1110	1800	2385	2915
1 1/2	188	680	1185	1640	2060	385	1180	1910	2535	3100
1 5/8	199	720	1255	1730	2180	407	1250	2020	2680	3275
1 3/4	209	758	1320	1825	2295	429	1315	2130	2825	3450
1 7/8	220	795	1385	1915	2410	450	1380	2235	2965	3620
2	230	832	1450	2005	2520	471	1445	2340	3100	3790
2 1/4	249	904	1575	2175	2740	511	1570	2540	3370	4115
2 1/2	268	973	1695	2340	2950	551	1690	2735	3625	4430
2 3/4	287	1040	1810	2505	3150	589	1805	2925	3875	4735
3	305	1105	1925	2660	3350	626	1915	3105	4120	5030
3 1/2	340	1230	2145	2965	3730	697	2135	3460	4590	5605

MACHINERY'S Data Sheet No. 587, June, 1947

Compiled by Canedy-Otto Mfg. Co.
Chicago Heights, Ill.

THRUST, IN POUNDS, REQUIRED FOR DRILLING—2

Drill Size	Feed, in Inches per Revolution									
	0.001	0.005	0.010	0.015	0.020	0.001	0.005	0.010	0.015	0.020
	Cast Steel					0.70 Per Cent Carbon Steel				
1/16	29	96	161	219	271	50	146	233	306	371
3/32	38	127	214	291	360	66	195	310	406	492
1/8	47	156	262	356	440	81	238	379	497	602
3/16	62	207	348	472	585	108	316	503	660	800
1/4	76	253	425	578	715	132	387	615	807	978
5/16	88	296	497	675	836	154	452	719	943	1145
3/8	101	336	565	767	950	175	513	817	1070	1300
7/16	112	374	629	855	1060	195	572	910	1195	1445
1/2	123	411	691	938	1160	214	628	999	1310	1590
9/16	134	446	750	1020	1260	232	682	1085	1425	1725
5/8	144	480	808	1095	1360	250	734	1170	1530	1860
11/16	154	514	864	1170	1450	267	785	1250	1640	1985
3/4	163	546	918	1245	1545	284	834	1325	1740	2110
13/16	173	577	971	1320	1630	300	882	1405	1840	2230
7/8	182	608	1020	1390	1720	316	929	1475	1940	2350
15/16	191	668	1075	1455	1805	332	975	1550	2035	2470
1	200	698	1125	1525	1890	347	1020	1620	2130	2580
1 1/8	217	725	1220	1655	2050	377	1110	1760	2310	2805
1 1/4	233	780	1310	1780	2205	406	1190	1895	2490	3020
1 3/8	250	834	1400	1905	2360	434	1175	2030	2660	3225
1 1/2	265	887	1490	2025	2510	461	1355	2155	2830	3430
1 5/8	280	938	1575	2140	2650	487	1435	2280	2990	3625
1 3/4	295	988	1660	2255	2795	513	1510	2400	3150	3820

MACHINERY'S Data Sheet No. 588, June, 1947

Compiled by Canedy-Otto Mfg. Co.
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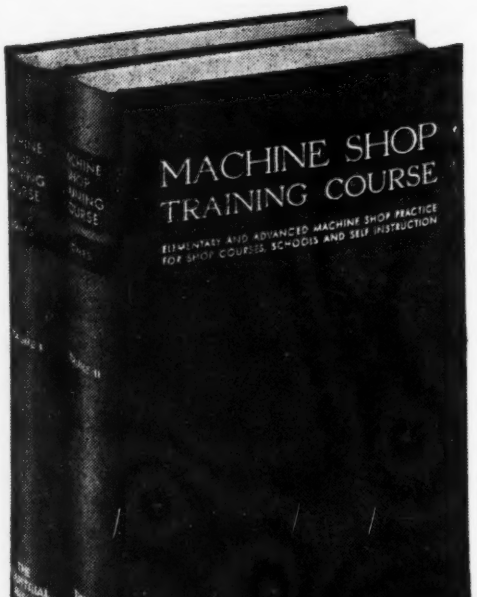
Machine Shop Training Course

WITH BLUEPRINT READING CHARTS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This standard treatise on machine shop practice in two volumes is for the shop man who wants to supplement his own experience with a broad fund of practical knowledge; for use as a textbook and guide in shop training courses; for technical or trade schools; for designers who want the fundamentals of machine shop practice; for mechanical engineering students.

The MACHINE SHOP TRAINING COURSE contains over 1100 pages of questions and answers. These questions deal with the elements of machine shop practice and other subjects closely allied to the work of the shop. The answers are packed with useful facts, shop rules, typical shop problems and their solutions. 524 drawings and photographs illustrate all kinds of machining operations, cutting tools, gages, etc.

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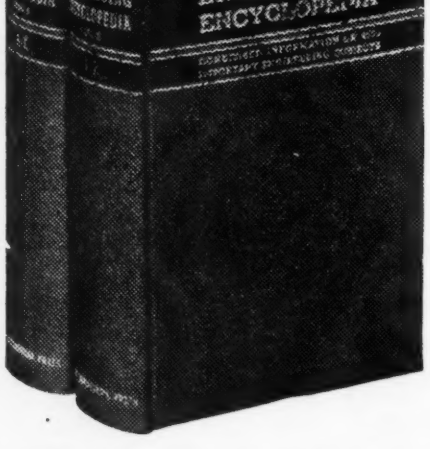

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The Engineering Encyclopedia is for everyone who can use essential facts about thousands of standard and special engineering subjects. It consists of clearly written concise treatises, definitions of terms used in engineering and manufacturing practice, and the results of many costly and important tests and experiments.

This work of reference supplies such practical and useful information as the important mechanical laws, rules, and principles; physical properties and compositions of standard and special metals used in machine construction and other engineering structures; characteristic features and functions of machine tools and other manufacturing equipment, and many other subjects. Price, $8.00 set.

THE INDUSTRIAL PRESS, 148 Lafayette Street, New York 13, N. Y.

Obituaries

August Tuechter

August H. Tuechter, president and general manager of the Cincinnati Bickford Tool Co., Cincinnati, Ohio, died on May 17 at the age of seventy-eight years. He recently completed his sixty-second year of association with the company, starting as an office boy on July 13, 1885, in the machine tool business of H. Bickford in Cincinnati. In 1887, he was made office manager of the company, then known as the Bickford Drill Co. Mr. Tuechter's progress with the organization was steady; in 1893, when the company was reorganized under the name of the Bickford Drill & Tool Co., he became general manager and partner in the business. In 1899, in partnership with S. C. Schauer, he formed the Cincinnati Machine Tool Co., specializing in the building of upright drilling machines, while the Bickford Drill & Tool Co. continued to make radial drills. In 1909, the two companies were consolidated under the name of the Cincinnati Bickford Tool Co., of which Mr. Tuechter became president.

A recognized leader in the machine tool industry, Mr. Tuechter was president of the National Machine Tool Builders' Association from 1920 to 1922, and was also president of the National Metal Trades Association. In addition to other industrial activities in Cincinnati, he took a prominent part in the philanthropic and welfare work of the community.

During his many years of activity in business, Mr. Tuechter made an unusual number of friends, both inside and outside of the machine tool industry. He enjoyed the friendship and respect alike of employes, business associates, customers, and all others who came in contact with him.

August H. Tuechter

Edward S. Montanus

Edward S. Montanus, president of the Springfield Machine Tool Co., Springfield, Ohio, died at his home, in Springfield, on April 28, at the age of sixty-two years. He was the son of P. E. Montanus, founder of the company. Edward Montanus was born on March 10, 1885, and received his education in the parochial school at Springfield, and in Wittenberg College. He entered the employ of the company as an apprentice in 1904, and progressed through various positions up to the presidency. Mr. Montanus served as president of the board of trustees for the Springfield City Hospital, and was a director of the Lagonda National Bank.

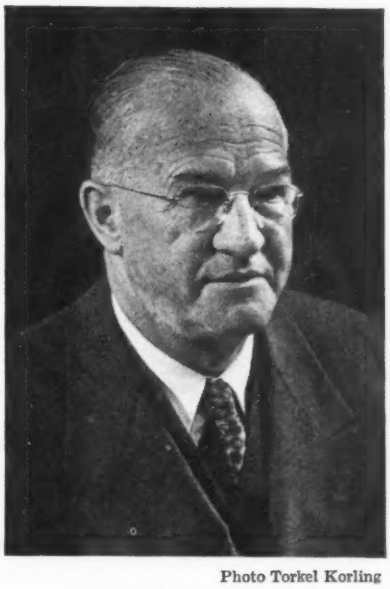


Photo Torkel Korling

Edward S. Montanus

Don G. Gardner

Don G. Gardner a well-known figure in the trade paper publishing field, died on May 15 at his home in Cincinnati. Mr. Gardner had been suffering from a nerve ailment. He was fifty-eight years of age. As head of Gardner Publications, Inc., Mr. Gardner was in charge of the publishing of three trade magazines—"Modern Machine Shop," "Products Finishing," and a Latin-American publication "El Taller Mecanico Moderno and Oficina Mecanica Moderna." The company was organized in 1928 by Mr. Gardner and Howard Campbell, who served as vice-president.

Mr. Gardner was born on May 26, 1889, at Monticello, Ind. He held various advertising posts with several newspapers in the West for a number of years. In 1918, he was appointed western manager of the W. R. C. Smith Publishing Co. of Atlanta, Ga. Later he was made southwestern manager of the *Iron Age*, which latter position he held until he founded his own company. He is survived by his wife and two daughters.

Don G. Gardner

Earle Graydon Leonard

Earle Graydon Leonard, manager of the Machine Tool Division of the Buffalo Forge Co. and a well-known figure in the machine tool industry, passed away at his home in Eggertsville, N. Y., on May 3 after a short illness. Mr. Leonard started working for the Buffalo Forge Co. in 1909. From a clerical position he advanced to the sales department from which he progressed to the post of manager of the Machine Tool Division. He had served on various important committees of the National Machine Tool Builders' Association.

* * *

Directory of Stamping Manufacturers

The third edition of the "Blue Book of Stamping Manufacturers" has recently been issued by the Pressed Metal Institute, 829 Union Commerce Bldg., Cleveland 14, Ohio. This directory is divided into three sections, the first of which contains an alphabetical list of the institute members; the second a list of members classified according to geographical location; and the third a list of the facilities of the various stamping manufacturers. Designers and purchasers of stampings can obtain copies by writing the Pressed Metal Institute at the address given above.

Coming Events

JUNE 1-6—Summer meeting of the SOCIETY OF AUTOMOTIVE ENGINEERS at the French Lick Springs Hotel, French Lick, Ind. Secretary and general manager, John A. C. Warner, 29 W. 39th St., New York 18, N. Y.

JUNE 2-4—Thirty-first annual meeting of the AMERICAN GEAR MANUFACTURERS ASSOCIATION at Hot Springs, Va. Newbold C. Goin, executive secretary, Empire Bldg., Pittsburgh 22, Pa.

JUNE 16-19 — Semi-annual meeting of the AMERICAN SOCIETY OF MECHANICAL ENGINEERS at the Stevens Hotel, Chicago, Ill. Secretary, Clarence E. Davies, 29 W. 39th St., New York 18.

JUNE 16-20—Annual meeting of the AMERICAN SOCIETY FOR TESTING MATERIALS at the Chalfonte-Haddon Hall, Atlantic City, N. J. Secretary, C. L. Warwick, 1916 Race St., Philadelphia, Pa.

JUNE 23-27—Annual convention of the AMERICAN ELECTROPLATERS SOCIETY AND INDUSTRIAL FINISHING EXPOSITION in Detroit, Mich. For further information, address the Society at 93 Oak Grove Ave., Springfield, Mass.

JUNE 25 — Annual meeting of the NATIONAL ASSOCIATION OF METAL FINISHERS, INC., in Detroit, Mich. Executive secretary, Raymond M. Shock, 2236-39 Dime Bldg., Detroit 26, Mich.

AUGUST 21-22 — West Coast transportation and maintenance meeting of the SOCIETY OF AUTOMOTIVE ENGINEERS at the Biltmore Hotel, Los Angeles, Calif. Secretary and general manager, John A. C. Warner, 29 W. 39th St., New York 18, N. Y.

SEPTEMBER 1-4—Fall meeting of the AMERICAN SOCIETY OF MECHANICAL ENGINEERS at the Hotel Utah, Salt Lake City, Utah. Secretary, Clarence E. Davies, 29 W. 39th St., New York 18, N. Y.

SEPTEMBER 8-12—SECOND NATIONAL INSTRUMENT CONFERENCE AND INSTRUMENT EXHIBIT in Chicago, Ill., under the auspices of the Instrument Society of America. Further information can be obtained from T. W. Robinson, chairman of the Exhibit Committee, 236 N. Clark St., Chicago 1, Ill.

SEPTEMBER 17-18—Tractor meeting of the SOCIETY OF AUTOMOTIVE ENGINEERS at the Hotel Schroeder, Milwaukee, Wis. Secretary and general manager, John A. C. Warner, 29 W. 39th St., New York 18, N. Y.

SEPTEMBER 17-26—MACHINE TOOL SHOW in Chicago, Ill., under the auspices of the National Machine Tool Builders' Association, 10525 Carnegie Ave., Cleveland 6, Ohio.

OCTOBER 2-4 — Autumn Aeronautic meeting of the SOCIETY OF AUTOMOTIVE ENGINEERS at the Biltmore Hotel in Los Angeles, Calif. Secretary and general manager, John A. C. Warner, 29 W. 39th St., New York 18, N. Y.

OCTOBER 30 - NOVEMBER 1 — Semi-annual meeting of the AMERICAN SOCIETY OF TOOL ENGINEERS in Boston, Mass. Executive secretary, Harry E. Conrad, 1666 Penobscot Bldg., Detroit 26, Mich.

NOVEMBER 3-5 — NATIONAL ELECTRONICS CONFERENCE at the Edgewater Beach Hotel, Chicago, Ill. Further information can be obtained from H. S. Renne, 185 N. Wabash Ave., Chicago 1, Ill.

NOVEMBER 6-7—Fuels and Lubricants meeting of the SOCIETY OF AUTOMOTIVE ENGINEERS at the Hotel Mayo, Tulsa, Okla. Secretary and general manager, John A. C. Warner, 29 W. 39th St., New York 18, N. Y.

DECEMBER 1-3—Air Transport meeting of the SOCIETY OF AUTOMOTIVE ENGINEERS at the Hotel Continental, Kansas City, Mo. Secretary and general manager, John A. C. Warner, 29 W. 39th St., New York 18, N. Y.

DECEMBER 1-5—Annual meeting of the AMERICAN SOCIETY OF MECHANICAL ENGINEERS in Atlantic City, N. J.; headquarters, Chalfonte-Haddon Hall. Secretary, Clarence E. Davies, 29 W. 39th St., New York 18, N. Y.

New Books and Publications

MANUFACTURING PROCESSES. By Myron L. Begeman. 626 pages, 5¾ by 8½ inches. Published by John Wiley & Sons, Inc., 440 Fourth Ave., New York 16, N. Y. Price, $5.

This is the second edition of a book dealing with manufacturing processes, engineering materials, and modern equipment necessary for processing these materials. The text has been revised and new material added to include the most recent advances in manufacturing methods. The contents cover: Foundry Practice; Pattern Work; Metal Casting; Special Casting Methods; Plastic Molding; Heat-Treatment of Steel; Powder Metallurgy; Welding and Allied Processes; Hot-Forming of Metals; Cold-Forming of Metals; Inspection-Measuring Instruments and Gages; Lathes and Lathe Tools; Threads and Thread Cutting; Shapers and Planers; Drilling and Boring Machines; Milling Machines and Cutters; Gears and Gear-Cutting Machines; Metal Sawing; Broaching Machines and Tools; Turret and Automatic Lathes; and Abrasives, Grinding Wheels, and Grinding Machines.

MILLING WITH CARBIDES. 41 pages, 8½ by 11 inches. Published by the Metal Cutting Tool Institute, 6400 Chrysler Bldg., New York 17, N. Y. Price, $1.

The Milling Cutter Division of the Metal Cutting Institute has prepared a comprehensive technical report on various phases of the subject of carbide milling. The report covers seven classifications as follows: General Considerations in Applying Carbides to Milling; Grades of Carbides and Their Application to Milling; Nomenclature for Carbide Milling Cutters; Machine Tools and Fixtures for Carbide Milling; Carbide Milling Cutter Design; Operating Techniques for Carbide Milling; and the Sharpening and Care of Carbide Milling Cutters.

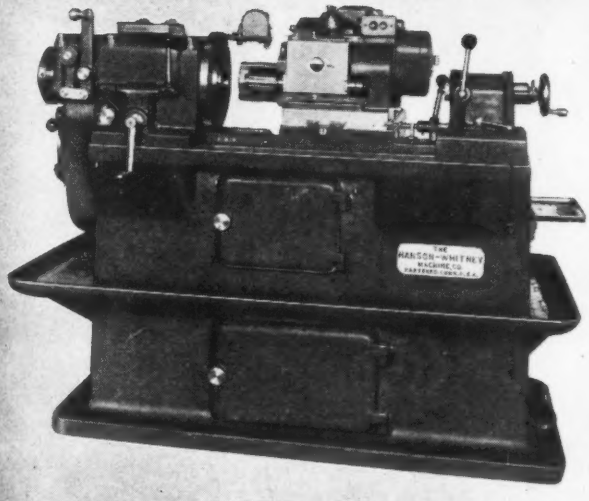
FUNDAMENTALS OF INDUSTRIAL ELECTRONICS CIRCUITS. By Walther Richter. 569 pages, 6 by 9 inches. Published by the McGraw-Hill Book Co., Inc., 330 W. 42nd St., New York 18, N. Y. Price, $4.50.

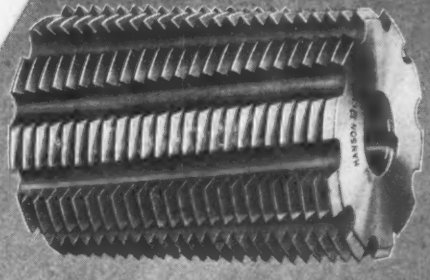
The primary purpose of this book is to explain the fundamental principles applying to circuits containing vacuum tubes and to reduce such circuits to a combination of more familiar circuit elements, so that the average electrical engineer and practical man can analyze the performance of the circuits and design them himself. The material is presented with a minimum of mathematics, so that the book can serve as a text for evening courses, where students may not have an extensive mathematical background.

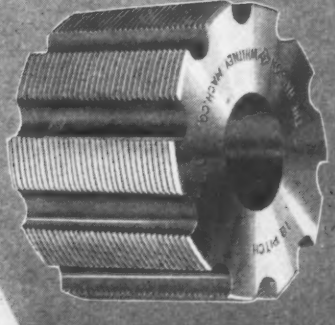
WELDED CHAIN. 16 pages, 5 3/4 by 9 inches. Published by the United States Department of Commerce, Washington, D. C., as Simplified Practice Recommendation R100-47 of the National Bureau of Standards. Copies are obtainable from the Superintendent of Documents, U. S. Government Printing Office, Washington 25, D. C., at 10 cents each.

A COMBINATION THAT'S HARD TO BEAT

. . . Hanson-Whitney semi-automatic thread milling machines and ground multiple thread milling cutters







This combination assures you speed . . . accuracy . . . no spoilage . . . economy and lower costs. Except for loading and unloading the H-W Thread Miller is entirely automatic and produces external or internal, right or left hand, straight or tapered threads in one revolution of the work. The cutters are finished all over after hardening, the spacing, form and relief being held to very close limits. They can be relied upon for accuracy and durability. Inquiries pertaining to thread milling problems respectfully solicited.

Hanson Whitney

MACHINE COMPANY

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Classified Contents

Design, Fixture and Tool

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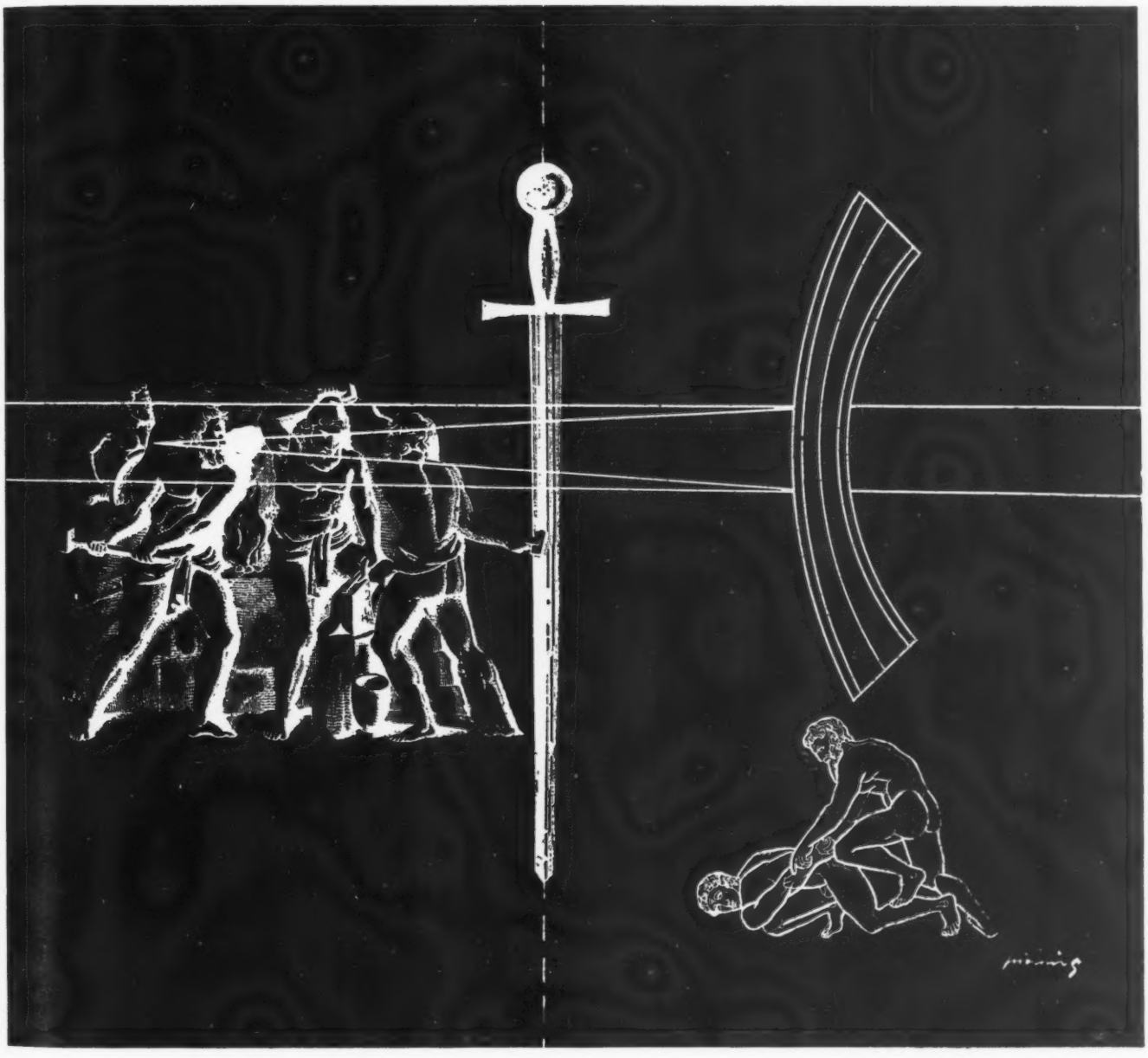
ONE CAME BACK

One of the legends surrounding the making of Damascus sword blades is that the smiths developed a delayed quench consisting of thrusting the heated blade into the body of a slave. This gave the required properties, but it was prodigal of manpower, and inconvenient besides. The smith usually had to leave town to do his heat treating in quiet.

Today, metallurgists can obtain properties they need in steel by simpler, less improvident means. A little molybdenum is one way of doing this. It is a proved means of obtaining the hardenability that assures good performance in service. Practical working data on molybdenum steels are available from Climax upon request.



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MOLY

TAPPAN STOVE gets Higher

500-ton Lake Erie Hydraulic Press in operation in the plant of The Tappan Stove Company at Mansfield, Ohio. Press is used for drawing, flanging and blanking operations in the manufacture of top rolls and main tops for Tappan Ranges.

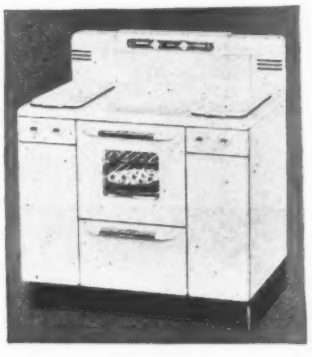
Quality Production with LAKE ERIE Hydraulic Press

Inserting a top roll blank in the Lake Erie Hydraulic Press. Top roll is formed in a single operation.

Top roll being removed from press. Uniformity is an important characteristic of parts produced on Lake Erie press.

In the manufacture of top rolls and main tops for its nationally-known line of ranges, The Tappan Stove Company has found that slow drawing on its Lake Erie Hydraulic Press permits the metal to flow properly. This eliminates wrinkles and hand work. Quality of the parts is improved, labor for hand work is saved, and further savings are made on inspections, which are greatly simplified.

This is another good example of the ability of today's hydraulic presses to simplify production, improve product quality or decrease production costs. It will be to your advantage to investigate the applications for hydraulic presses in the manufacture of your products with a view to improving their quality or decreasing their costs. Lake Erie engineers, through their day-to-day consultations with leading manufacturers in all branches of industry, have a wealth of information on hydraulic press applications. They will be glad to assist you in any way. Merely call on them.



● Leading manufacturer of hydraulic presses—all sizes and types—metal working...forging... metal extrusion... plastic molding... processing...rubber vulcanizing...stereotyping...special purpose.

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ENGINEERING CORP.
BUFFALO, N.Y. U.S.A.

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HYDRAULIC PRESSES AND SPECIAL MACHINERY
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OFFICES IN PRINCIPAL CITIES AND FOREIGN COUNTRIES

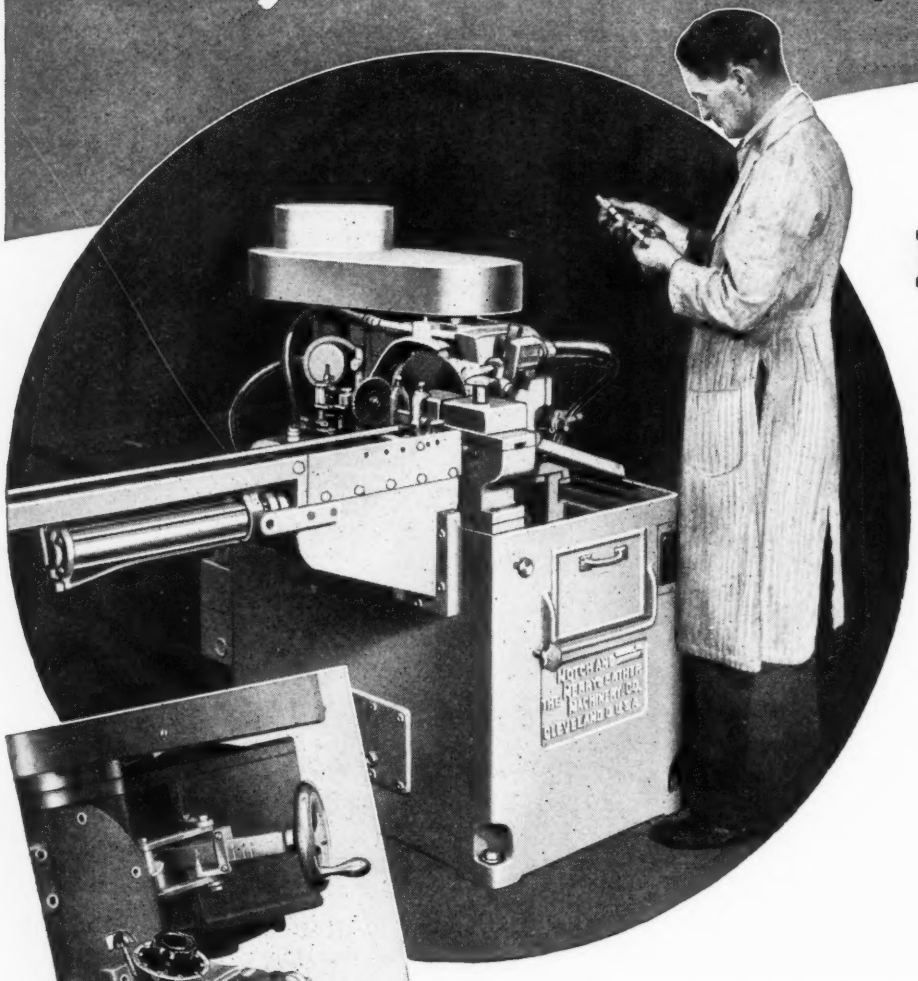
The Answers are Here...

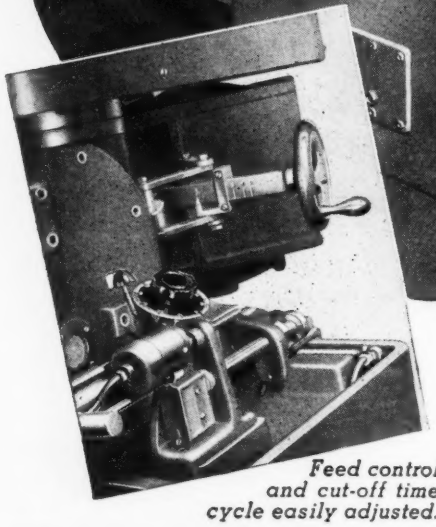
in the Motch & Merryweather

No. 00

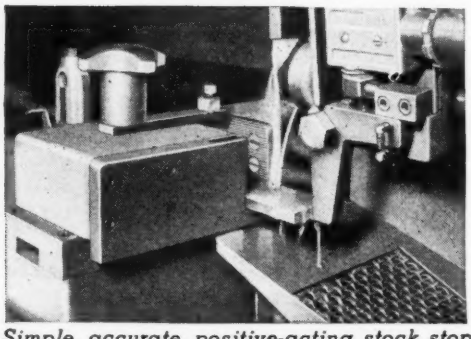
CIRCULAR SAWING MACHINE

Triple-Chip METHOD





Feed control and cut-off time cycle easily adjusted.



Simple, accurate, positive-acting stock stop starts automatic clamping and sawing cycle.

All the proven fundamentals of Motch & Merryweather design and construction which insure smooth, clean, burr-less sawing and eliminate most second operations. Accurate, uniform lengths; high speeds; quick change from size to size and material to material for stock up to 2". Thorough-going Motch & Merryweather engineering has provided Triple-Chip blades to fit and a blade sharpener to grind them — an experience based on "building all 3". The answers within this range of work are here.

For more information write for our well illustrated Bulletin M-600.

THE MOTCH & MERRYWEATHER MACHINERY CO.
PENTON BUILDING CLEVELAND 13, OHIO

MEN
skilled by
experience
•
MATERIALS
selected for each
job
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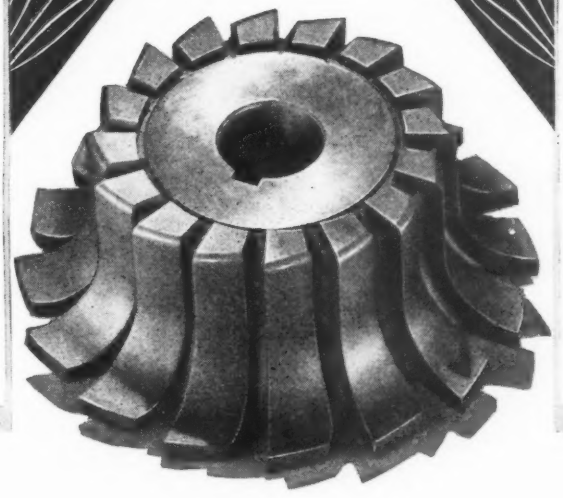
MACHINERY
that assures
precision



Herringbone Cutters,
Broaches, Gear Cutters,
Gear Shaper Cutters,
Circular and Flat Form
Tools,
Form Relieved Cutters,
ground and unground,
Hobs,
ground and unground,
Milling Cutters,
Special Tools

NATIONAL
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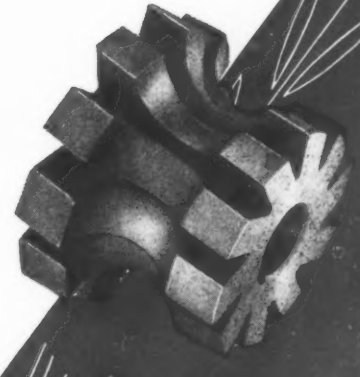
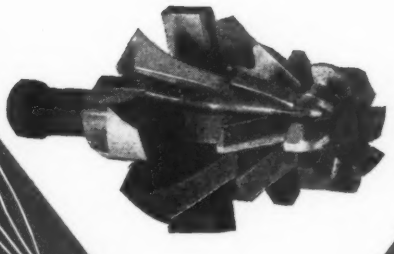
TOOLS

NATIONAL Tools CLEVELAND

Cutting Tools for
All Purposes





NATIONAL TOOL Co.
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CLEVELAND, OHIO

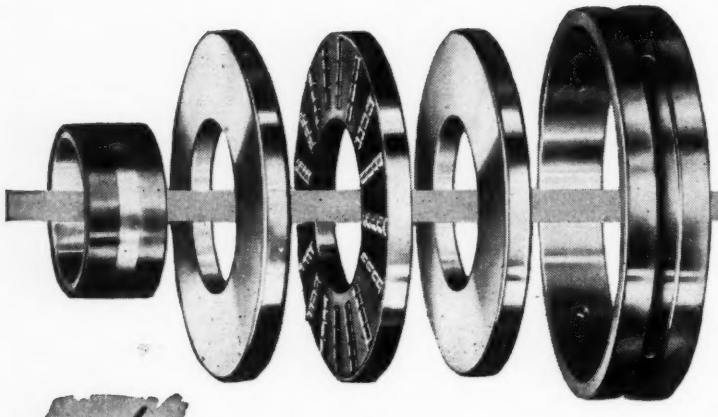
SPLIT YOUR LOAD IN TWO !

with

ROLLWAY

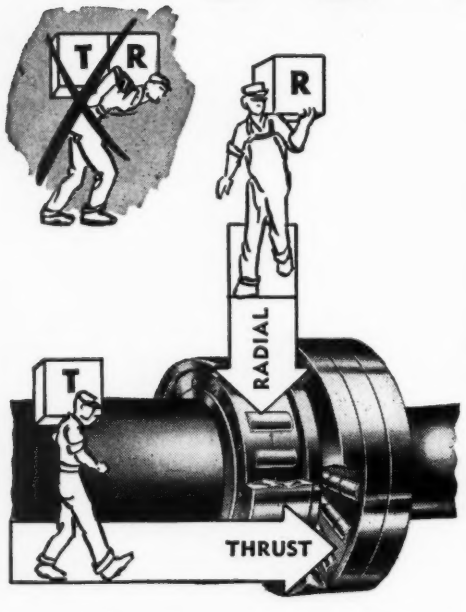
RIGHT-ANGLE-LOADED

BEARINGS

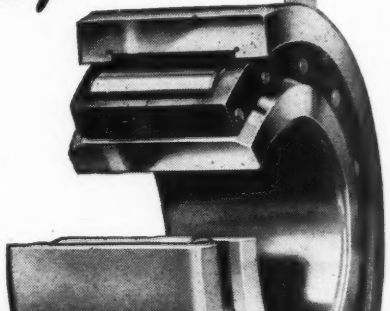


Right-Angle Loading splits compound loads into the two component parts of pure radial and pure thrust... and carries each of these components on separate bearing assemblies. **Simple but scientifically sound.**

1. **Keeps bearings free of complicated stresses**
2. **Gives longer bearing life with higher capacity**
3. **Cuts maintenance cost and lay-up time**



What Right-Angle-Loading Does!



1. Prevents wedging of rollers and pinch-out. Reduces roller end-rub, with its wearing friction. Holds starting and operating torque at a minimum.
2. Since only pure radial or pure thrust loads can be imposed upon any single bearing assembly, unit pressures are reduced substantially.
3. Since all loads are carried at right-angles to the roller surface, compound or oblique loads are avoided and so are the resultants of the oblique loads.
4. Right-angle loading permits greater radial or thrust load-carrying capacity in any given dimension.
5. Right-angle loading assures solid cylindrical rollers of greater roller mass and uniform roller cross-section . . . greater resistance to shock loads and vibration . . . longer life expectancy under continuous heavy-duty service.

Free Service!

Select the RIGHT bearings for YOUR particular needs . . .

Rollway engineers will gladly make necessary calculations, drawings and supply other required information for a complete understanding of your bearing problem. No charge.

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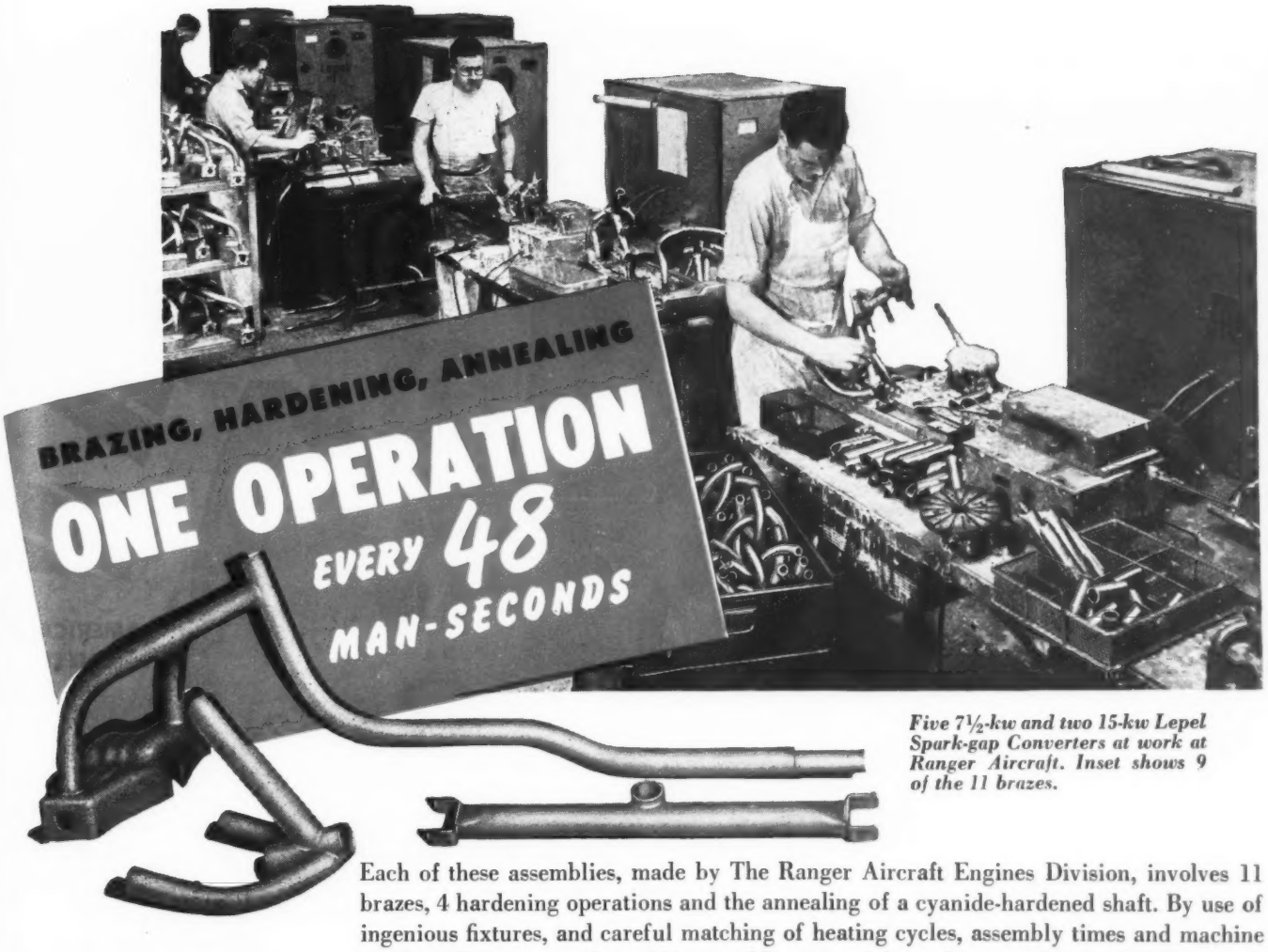

Five 7½-kw and two 15-kw Lepel Spark-gap Converters at work at Ranger Aircraft. Inset shows 9 of the 11 brazes.

Each of these assemblies, made by The Ranger Aircraft Engines Division, involves 11 brazes, 4 hardening operations and the annealing of a cyanide-hardened shaft. By use of ingenious fixtures, and careful matching of heating cycles, assembly times and machine capacity, Ranger completes 320 assemblies in an 8-hour day — with just eight operators and seven Lepel High-frequency Heating Units.

Most of the steel-to-steel brazes are handled in pairs, with heating cycles ranging from 10 to 60 seconds. Jigs and snap-closing spring clamps position the accurately cut tubing; silver-alloy rings provide the brazing metal.

Heat treating with same units provides flexibility. Where 320 brazes can be completed in less than 8 hours, converters and fixtures are changed over to annealing or hardening in a matter of minutes. The annealing is done at a rate of 240 parts per hour; hardening, with water quenching, at rates up to 333 per hour.

This installation was worked out by Ranger's production men in co-ordination with Lepel engineers. In flexibility, speed, quality and excellent working conditions, it has turned a difficult assignment into a routine production job.

SOLDERING
BRAZING
HARDENING
ANNEALING
MELTING

The same Lepel Spark-gap Converter will handle any or all of these processes, usually with advantages similar to those given in this advertisement. Often this unit will prove substantially more economical than any other high-frequency generator—*particularly when heating non-ferrous or non-magnetic materials.* **Changing from one job to another can be done in less than 5 minutes.**

If you have any operation — on ferrous or non-ferrous materials — which you think might be handled by high-frequency heating, let us make a quick preliminary investigation. If promising, our engineers can run tests, on samples you supply, and report just what can be done. There is no obligation; inquiries are treated with strictest confidence.

A letter to us will bring you, as you prefer, our latest catalog or a call by a representative. Any description of part or process which you can give may enable us to furnish, immediately, specific helpful data. You can help us by mentioning this advertisement.

HARDEN

SOLDER

BRAZE

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LEPEL HIGH FREQUENCY LABORATORIES
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CHICAGO, SEPT. 17-26, BOOTH 271

CUSHMAN

AMERICA'S FINEST

HEAVY DUTY 3-JAW SELF-CENTERING CHUCKS

Designed and built to meet the requirements of heaviest duty service on turret and automatic lathes with carbide tools. The jaws, of hardened alloy steel, are deeply seated on wide body ribs. Jaws are tested to center within .003" total indicator reading. Bodies are of forged steel, heavily ribbed. Pinions and scrolls are extra heavy for use with long handle or power wrenches. Available for American Standard Type A-1 Spindles.

These chucks when fitted with soft blank top jaws and formed to hold work piece of special form provide adaptability to work requirements at minimum cost.

OTHER CUSHMAN STYLES & TYPES

4-Jaw Independent Chucks
Light, Medium and Heavy Duty

•

3 and 4-Jaw Self-Centering Chucks
Light, Medium and Heavy Duty

•

3 and 4-Jaw Combination Chucks
Medium and Heavy Duty

2-Jaw Chucks •
Medium and Heavy Duty

•

Collet Chuck and Collets

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Power Chucks, a complete line

•

Rotating and Stationary Air Cylinders
and Accessory Equipment

•

Power Wrenches •

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THE CUSHMAN CHUCK COMPANY
HARTFORD 2, CONNECTICUT, U. S. A.

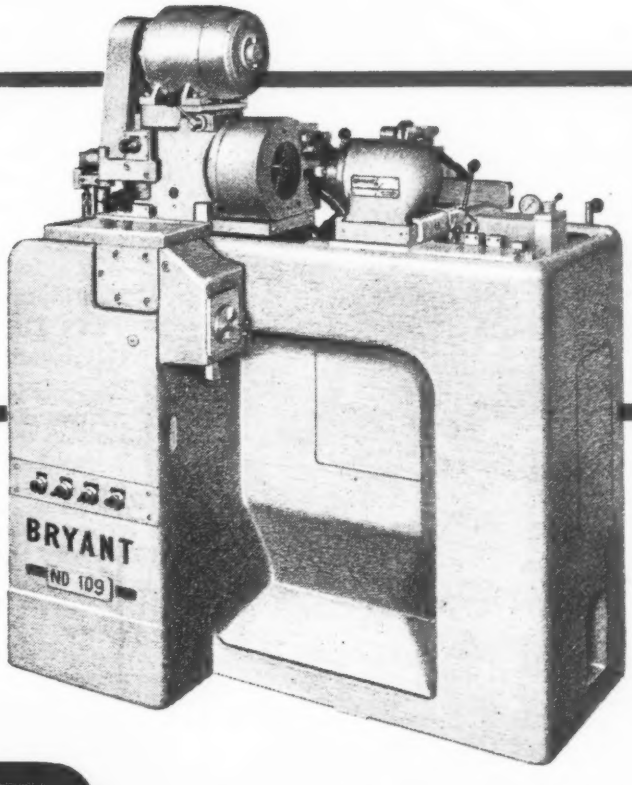
prolific perfectionist

The Bryant No. 109 Internal Grinder produces rapidly, automatically and in volume such parts as ball bearing races, gears, rolls and bushings with bore sizes up to 3". It *automatically* rough grinds, trues the wheel, finish grinds and stops when finish size is reached. Bore size is also controlled *automatically* by the wheel trueing diamond or by a plug gaging unit operating through the work spindle. Thus the operator need only load the work, trip the cycle lever and then unload the finished part — often operating two machines with little effort.

Exclusive Bryant set-up features include split-second cycle control of the wheel-slide through four adjusting throttles. Timing devices for "spark out" are provided for both rough and finish grinding. Hydraulic motors give infinitely variable work speeds and cross feeds. Preloaded ball bearing sealed slides for longitudinal and cross motions give super-smooth control of work and wheel. For proper cutting characteristics on extremely small bores, the Bryant Hi-Frequency Wheelhead offers speeds up to 100,000 r.p.m. Belt-driven spindles are used for the larger range of bore sizes.

The No. 109 is a high production machine, yet grinds bores to the finest tolerances and with work finishes of unbelievable accuracy. For details on this "Prolific Perfectionist," write for catalog.

NUMBER 109
Automatic
INTERNAL GRINDER



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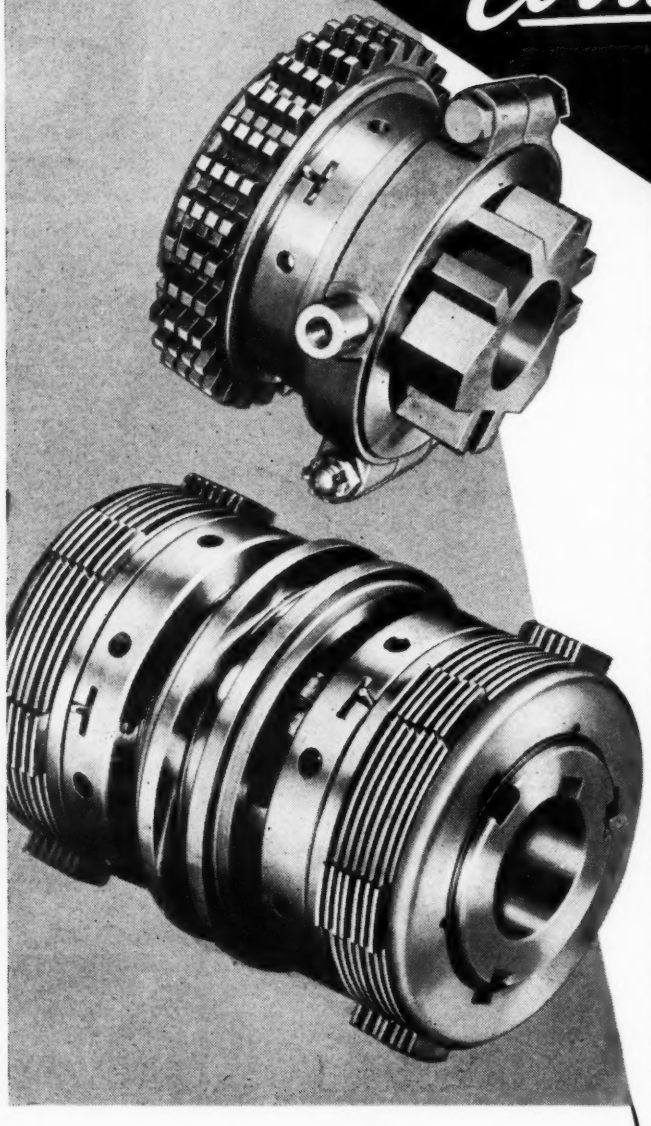
Accurately Rated... Correctly Applied



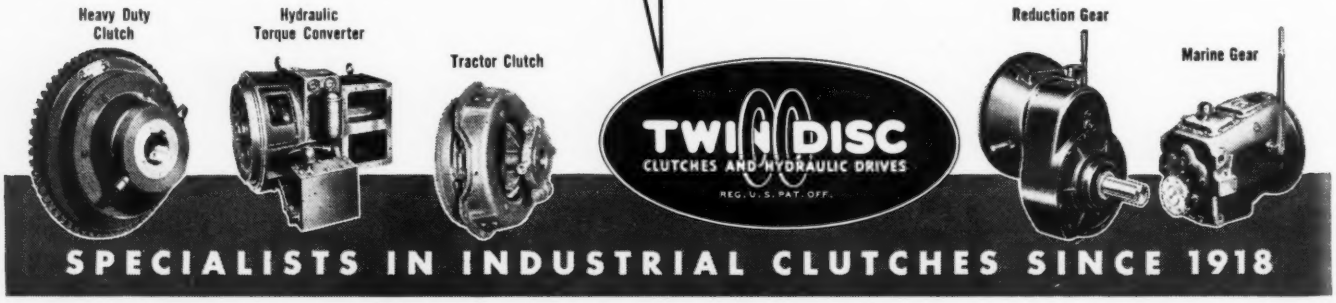
When you specify a Twin Disc Machine Tool Clutch, you can be sure that it will be accurately rated for and correctly applied on your equipment.

Each new Twin Disc Machine Tool Clutch is thoroughly pre-tested on a specially designed testing stand where all the variables that influence clutch performance and wear-life characteristics are explored. Research data obtained by these scientific methods is correlated by Twin Disc engineers with information about your operation. This assures you of accurately rated, correctly applied Twin Disc Machine Tool Clutches because these engineers are constantly solving operating problems similar to yours . . . are continually doing research and checking performance in the field.

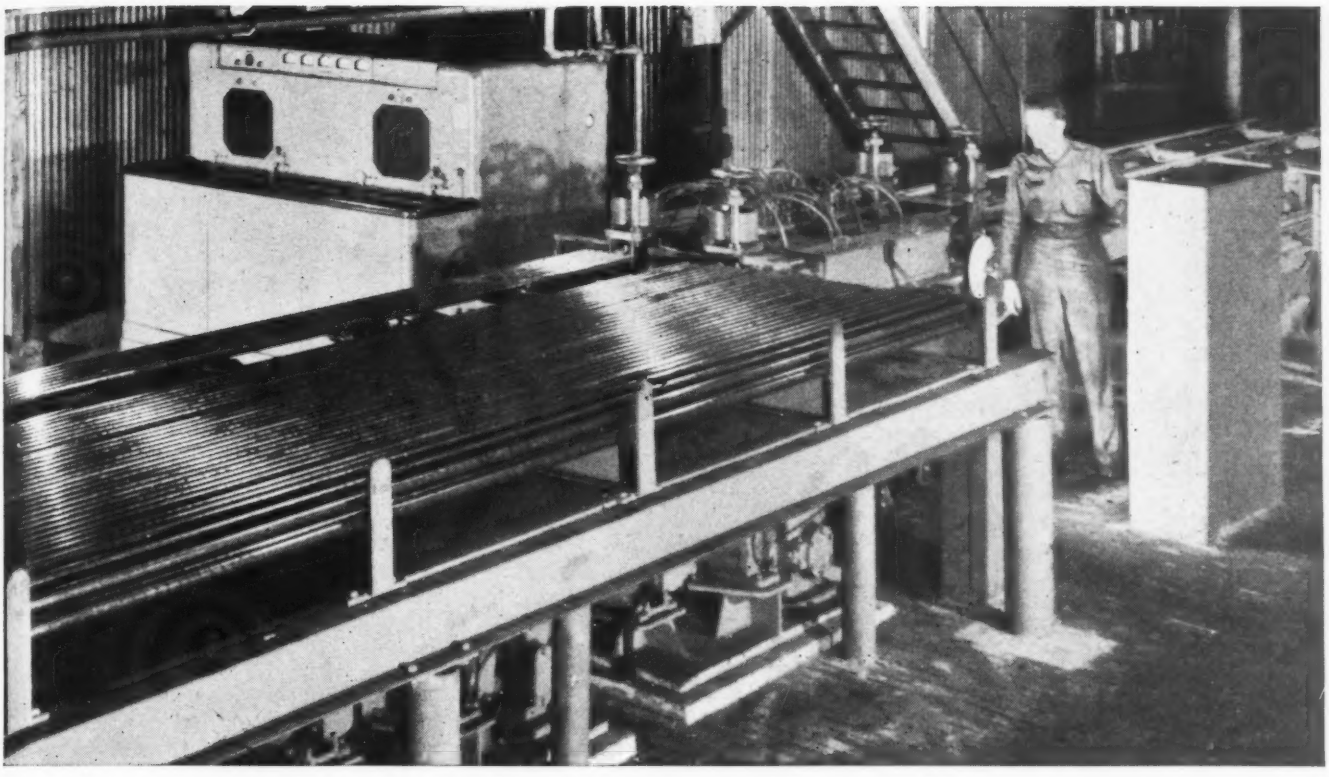
Write the Twin Disc Clutch Company, Racine, Wisc., for Bulletin No. 134A which gives detailed information about Twin Disc Machine Tool Clutches. TWIN DISC CLUTCH COMPANY, Racine, Wisconsin (Hydraulic Division, Rockford, Illinois).

Top: The Model MTS (single) Clutch is furnished in both oil and dry type sizes from 3" to 9". Working torque ranges from .47 to 15 hp per 100 rpm in the oil type, and from .9 to 18 hp per 100 rpm in the dry type.

Bottom: The Model MTU (duplex) Clutch is furnished in both oil and dry type sizes from 3" to 9". Working torque ranges from .47 to 15 hp per 100 rpm in the oil type, and from .9 to 18 hp per 100 rpm in the dry type.



SPECIALISTS IN INDUSTRIAL CLUTCHES SINCE 1918



J&L steps up *Quality* of bars with TOCCO Induction Hardening

• Jones & Laughlin Steel Corporation, the first steel company to use induction hardening for treatment of steel bars, reports that it is passing on to its customers these benefits in improved quality:

1. INCREASES UNIFORMITY of metallurgical structure as to *hardness* and *depth of hardness*—throughout its entire length and cross-section.

2. IMPROVES MACHINING. Elimination of hard and soft spots promotes consistent uniformity of machining.

3. IMPROVES SURFACE. Speedy, localized hardening practically eliminates scale and distortion for greater product quality.

4. MINIMIZES METAL LOSS. Less skin removal through decarburization.

J & L is now TOCCO hardening cold-finished round bars in lengths of 10 ft. to 24 ft., in diameters of ½", ¾", ⅞", 1", 1⅛", 1 3/16" and 1 7/16"; will process 2" bars soon; and expects also to treat flat and hex stock.

The completely automatic work handling equipment with TOCCO Induction Heating unit is shown above. Controls are readily adjusted to suit the size of bars to be treated and the degree and depth of hardness desired.

TOCCO Engineers will gladly explain the TOCCO process and study its application to your particular problems.

THE OHIO CRANKSHAFT COMPANY

FREE BULLETIN

TOCCO

Mail Coupon Today

THE OHIO CRANKSHAFT CO.
Dept. M-4, Cleveland 1, Ohio

Send bulletin giving further details on the J & L bar stock application.

Name_____

Company_____

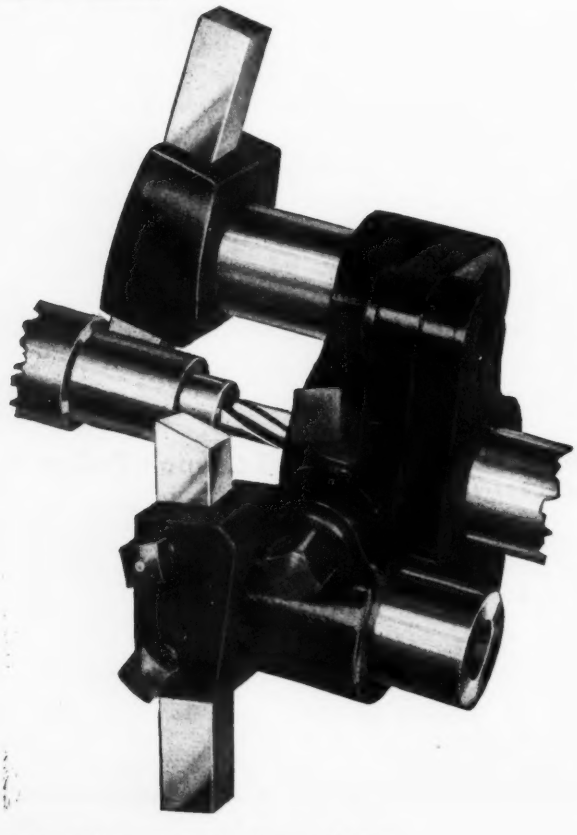
Address_____

City_____ Zone____ State____

R and L Turning Tool set up for drilling, turning and burnishing in one operation. Note ample room for chip clearance.

HERE ARE SOME TOOLING SHORTCUTS

R and L Turning Tool set up for turning two diameters while drilling or reaming.



The two set-ups shown are but two of the dozens of "combined operations" which R and L Turning Tools make possible. Their multiple use, multiple operation features point the way to tooling shortcuts by enabling you to set up as many as three different operations on one turret. Perform drilling and turning; turning, centering and burnishing; pointing and form turning; turning two diameters and other similar jobs with this single, simple tool. Ruggedly built, and simplicity itself, the R and L Turning Tool will increase your production capacity and lower maintenance costs. Built in five sizes to fit most machines, they are described in full in the R and L Booklet. Write for your copy of this valuable, idea-full data book today.

R AND L TOOLS

1825 BRISTOL ST.

NICETOWN – PHILADELPHIA 40, PA.

8 PRODUCTION OPERATIONS

COMBINED IN 1 MACHINE . . .

Such designing of a single purpose multi-tool machine is done for one purpose—higher production at lower costs without sacrificing quality of work.

Baush has led the field in this respect for over 50 years. Our Engineers are at your service—let them work with you on production problems — there is no obligation — their experience is yours for the asking.

Baush Two-Way Horizontal No. 30 Hydraulic Unit Type Multiple Spindle Drilling Machine:

Part being machined:—Connecting Rod Cap. Six-station hydraulically indexed trunnion type Fixture holds (3) Automotive Connecting Rod Caps at each station, caps located on mating and end-milled surfaces.

OPERATIONS SEQUENCE:

Station 1—Unload and load (3) Caps

Station 2—L.H. Head—Combination center drill and chamfer (6) holes
R.H. Head—Chamfer (6) holes

Station 3—L.H. Head—Spotface (6) holes
R.H. Head—Drill (6) holes

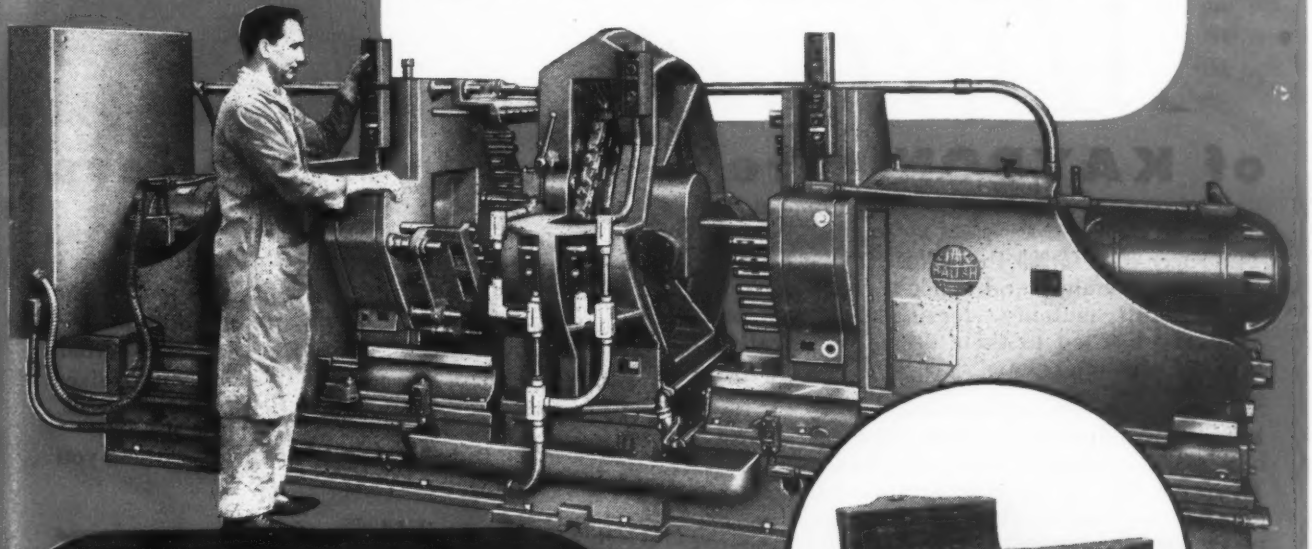
Station 4—L.H. Head—Drill (6) holes
R.H. Head—Idle

Station 5—L.H. Head—Finish spotface (6) holes
R.H. Head—Re-drill (6) holes

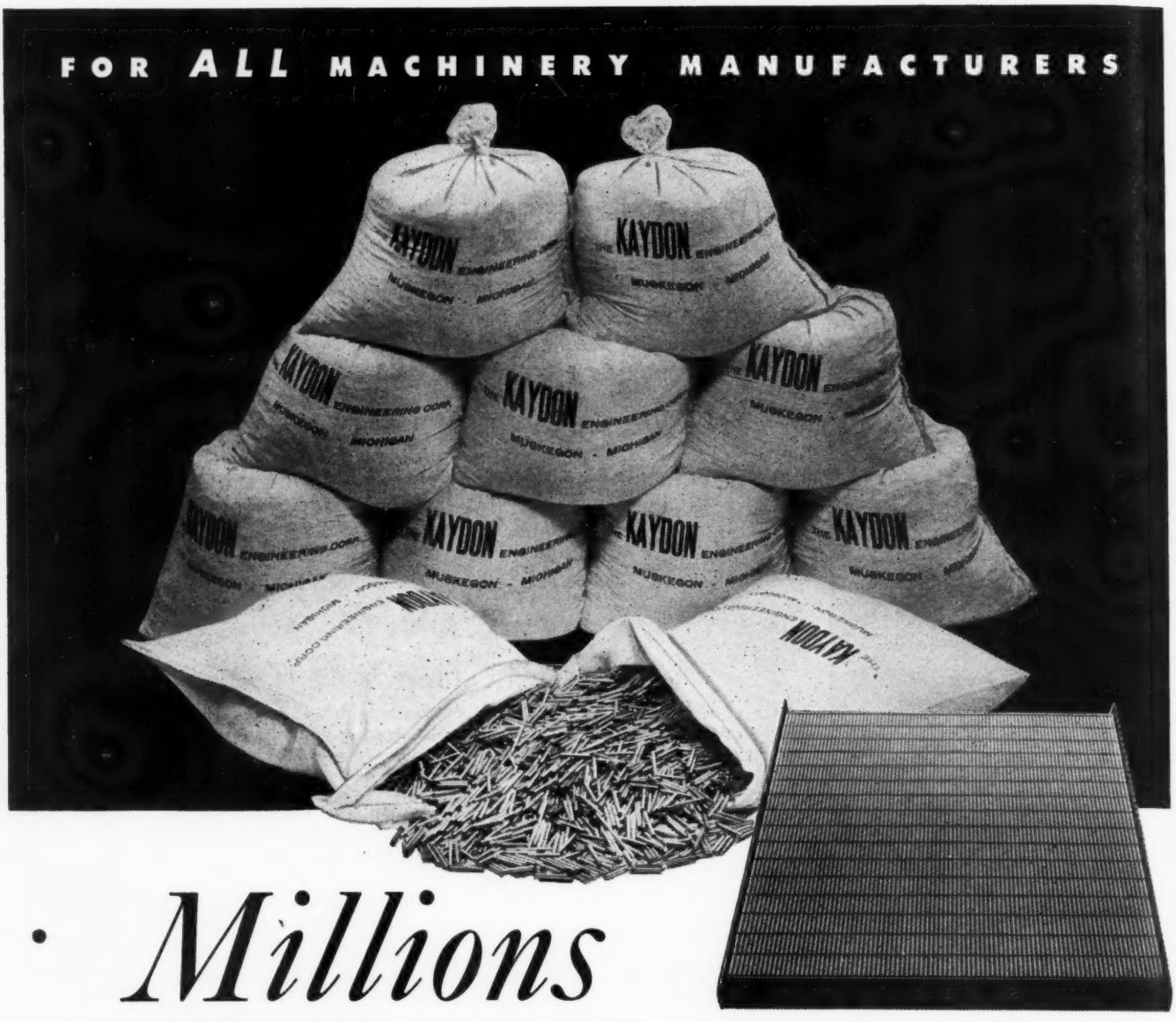
Station 6—L.H. Head—Counterbore (6) holes
R.H. Head—Ream (6) holes

SPECIFICATIONS:

Base of welded steel with ample coolant trough and sump—with full flow of coolant to all cutting tools. Hydraulic units are self contained with hydraulic pumps and cylinders—18" stroke and adjustable feed rates. Unit ways are hardened and ground steel —units arranged with pick-off gears for speed changes. Ball bearings fixed center heads—left head furnished with 30 spindles—right head with 24 spindles. Each unit has 15 H.P. motor for spindle and pump drive. Floor space required—13 ft. 6 in. overall length by 3 ft. 6 in. wide—Approximate Net Weight 20,000 lbs.



BAUSH
MACHINE TOOL CO.
SPRINGFIELD 7, MASSACHUSETTS



• *Millions*

of KAYDON *precision needle rollers

*Tolerance on diameter .0002". On the Inspection Board shown above are KAYDON Needle Rollers .1250" diameter.

The success of KAYDON Precision NEEDLE ROLLERS in automobile and truck transmissions, universal joints, clutches, steering gears and other products, has led to their use in practically all types of machinery.

Since these needle rollers may be used between hardened shafts and hardened bores of housings or gears, they eliminate the need for bearing races. Thus they provide the most compact high-capacity anti-friction bearing possible, requiring little or no more space than so-called plain or "solid" bearings.

Millions of these precision needle rollers are being made in standard sizes, 1/16" to 5/16" diameters (tolerance .0002" on diameter), flat or rounded ends. Other sizes are being added as "standard" when quantities warrant.

By using standard sizes that are now in big volume production, you get the benefit of low cost for highest performance-proved quality in small or large quantities . . . but regardless of whether your machine design permits use of standard sizes or demands special needle rollers, contact KAYDON.

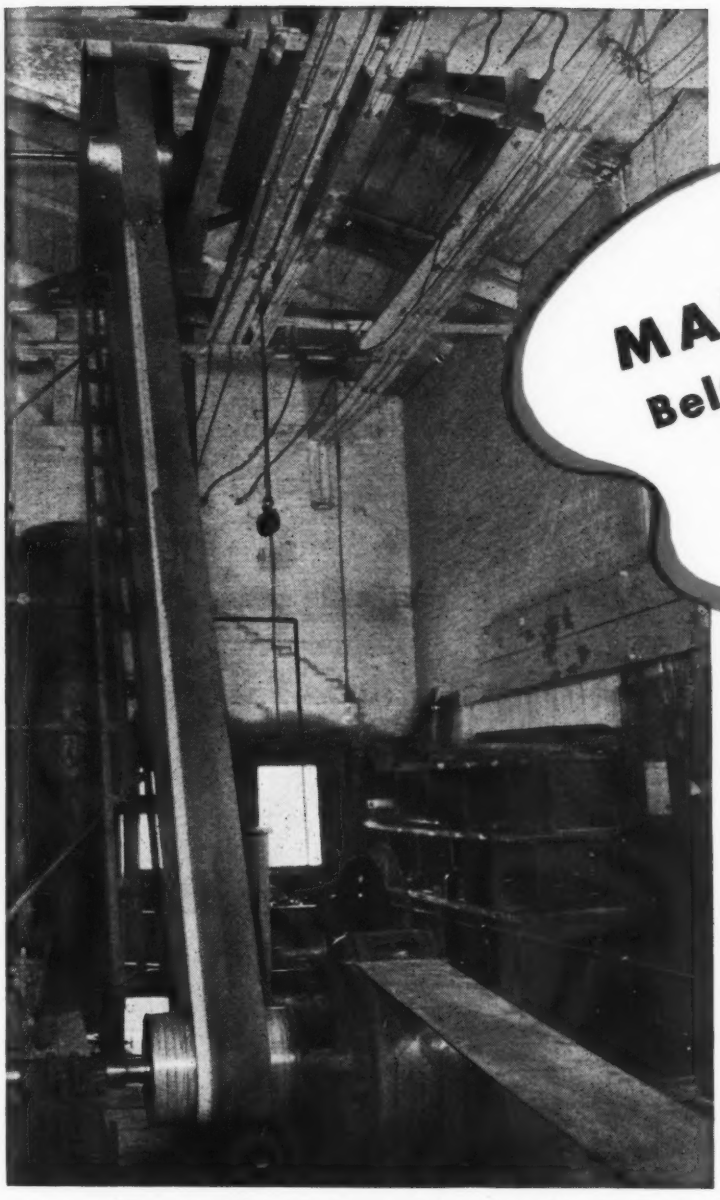
Be sure to state sizes and quantities when you send your inquiries.

Capacity also available now for all types and sizes of KAYDON Standard or Special Bearings. It pays to "contact KAYDON of Muskegon."

KAYDON *Types of Standard or Special Bearings:*
Spherical Roller • Taper Roller • Ball Radial
Ball Thrust • Roller Radial • Roller Thrust

THE KAYDON ENGINEERING CORP., MUSKEGON, MICH.

All types of Ball and Roller Bearings 4" bore to 120" outside diameter



This MANHATTAN Belt . . . gave 22 years continuous service

. . . traveled 1,448,864 miles

The 18-inch, 5-ply Manhattan Transmission Belt pictured here was held in storage over 4 years, followed by 22 *years* of actual service. It operated a line shaft in the machine shop of the Huntington and Broad Top Mountain Railroad and Coal Company. This drive is nearly vertical which means that a higher than normal belt tension had to be maintained to prevent slip.

We quote directly from a letter from Mr. F. E. Steele, Superintendent:

> "It is my personal opinion that this is a remarkable service for a belt of this type when we take into consideration the fact that drive pulley was 14 inches in diameter. This within itself would throw considerable strain on a belt of this width and weight, also with a speed of approximately 2,383 feet per minute. During this period of operation we had no trouble whatsoever and at all times the belt worked very satisfactorily."

A lacer accident finally ended its career.

> "Should this accident not have happened, the belt would still be in service and doing a good job."

This is one of many case histories to which Manhattan can point for proof of Workmanship and Quality Materials . . . reasons why Manhattan has long been famous for its belts. Whatever the job, there's a Manhattan Belt that will lower *your* costs, too.

A SINGLE SOURCE for a COMPLETE BELTING LINE

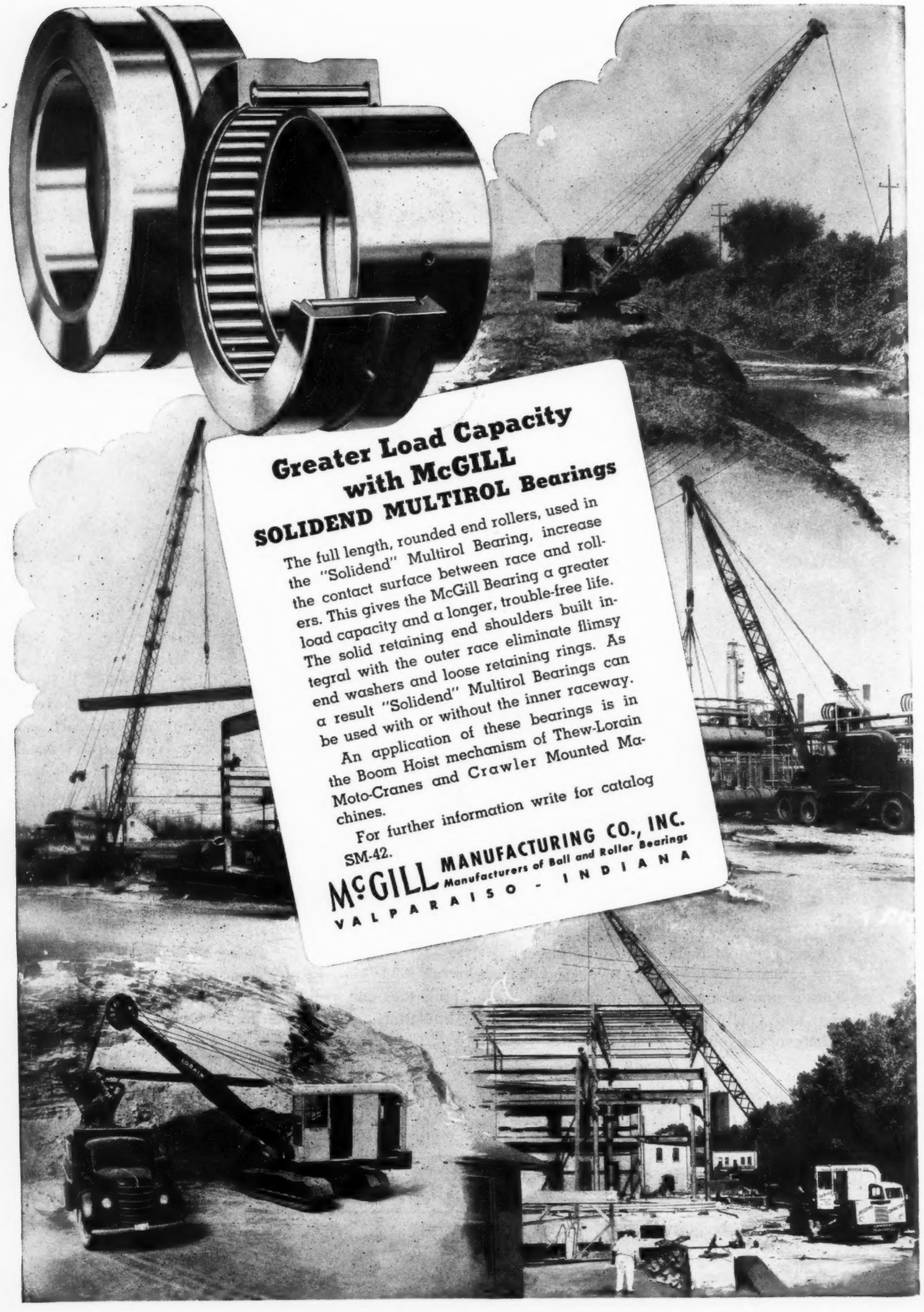
Manhattan offers a range of four driving tension surfaces on rubber transmission belts. Also Endless Cord, Non-Spark, Oil-Proof and Acid-Proof constructions. Belts can be factory-made endless or field vulcanized by the Condor-Weld method. All Manhattan endless belts have the patented Extensible-Tip outer-ply splice which prolongs belt life considerably. Literature on request.

RAYBESTOS R M MANHATTAN

RAYBESTOS-MANHATTAN INC.

Keep Ahead with Manhattan

MANHATTAN RUBBER DIVISION **PASSAIC, NEW JERSEY**



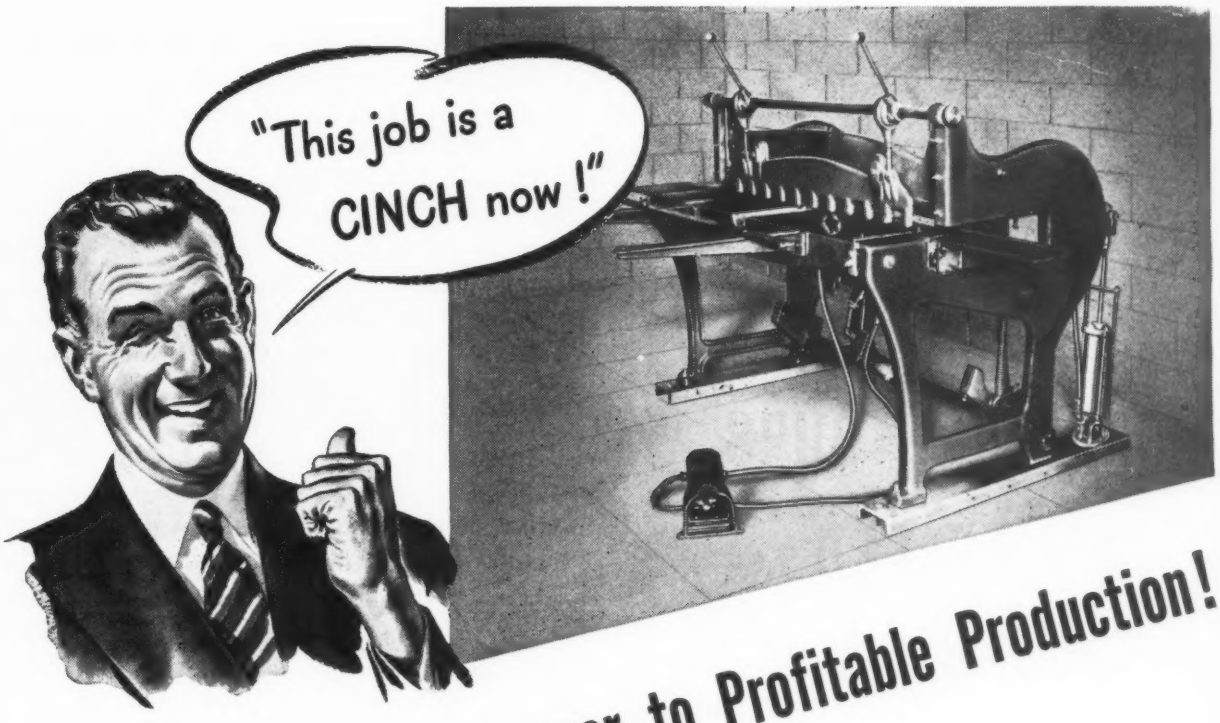
Greater Load Capacity with McGILL SOLIDEND MULTIROL Bearings

The full length, rounded end rollers, used in the "Solidend" Multirol Bearing, increase the contact surface between race and rollers. This gives the McGill Bearing a greater load capacity and a longer, trouble-free life. The solid retaining end shoulders built integral with the outer race eliminate flimsy end washers and loose retaining rings. As a result "Solidend" Multirol Bearings can be used with or without the inner raceway.

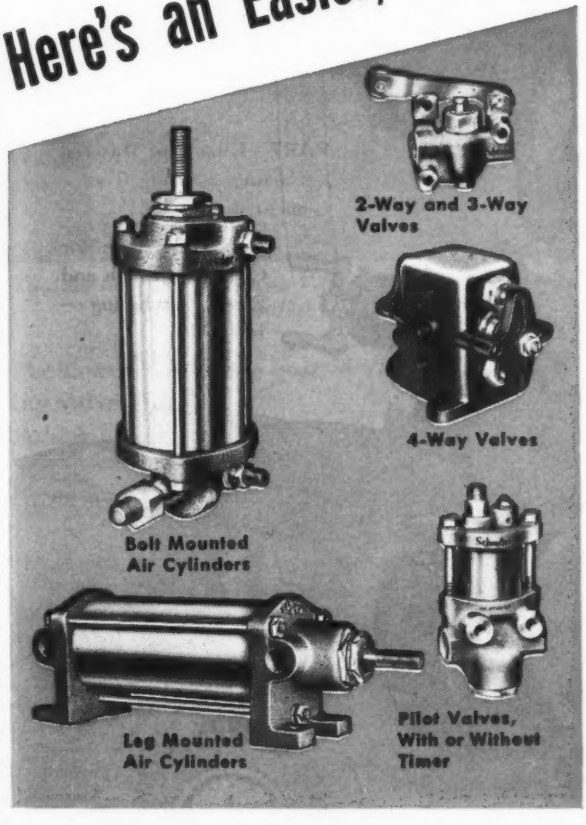
An application of these bearings is in the Boom Hoist mechanism of Thew-Lorain Moto-Cranes and Crawler Mounted Machines.

For further information write for catalog SM-42.

McGILL MANUFACTURING CO., INC.
Manufacturers of Ball and Roller Bearings
VALPARAISO - INDIANA



Here's an Easier, Quicker Answer to Profitable Production!


2-Way and 3-Way Valves
4-Way Valves
Bolt Mounted Air Cylinders
Leg Mounted Air Cylinders
Pilot Valves, With or Without Timer

Can you improve production and safety of manufacturing operations quickly and easily without expensive alterations to plant or machinery?

Yes! By using compressed air, efficiently controlled by Schrader Valves and Air Cylinders, to operate your machines. Take this shearing machine for instance: by converting to air control, production is boosted, operator fatigue eliminated, and there is far greater ease and versatility of operation. Not only that but with air power you can frequently shear heavier gauge metal. This is a typical illustration of what Schrader Valves and Cylinders can do when put to work on shearing machines, power presses, welding machines, kick presses, arbor presses and many other essential machines.

Consider Schrader Valves and Cylinders as production boosters in your plant. Installation can often be made with little or no extra load in your present compressor capacity.

Schrader Air Cylinders and Valves give you efficient control of compressed air. Help you accomplish more—in less time—with less manpower used.

For further information on how these Schrader products can help you, write today to Department 11.

EVERYTHING FOR EFFICIENT AIR CONTROL

Air Cylinders, Operating Valves 2, 3 and 4-way (hand, foot and remote control), Press Operating Controls, Pneumatic Machine Controls (all types), Air Ejection (Knockout) Sets, Quick Acting Couplers, Blow Guns, Air Hose and Fittings, Hydraulic Gauges.

A. SCHRADER'S SON · BROOKLYN 17, N. Y.

Division of Scovill Manufacturing Company, Incorporated

Schrader
PRODUCTS CONTROL THE AIR

BORED CONTOURS AIR-TRACED

for greater accuracy

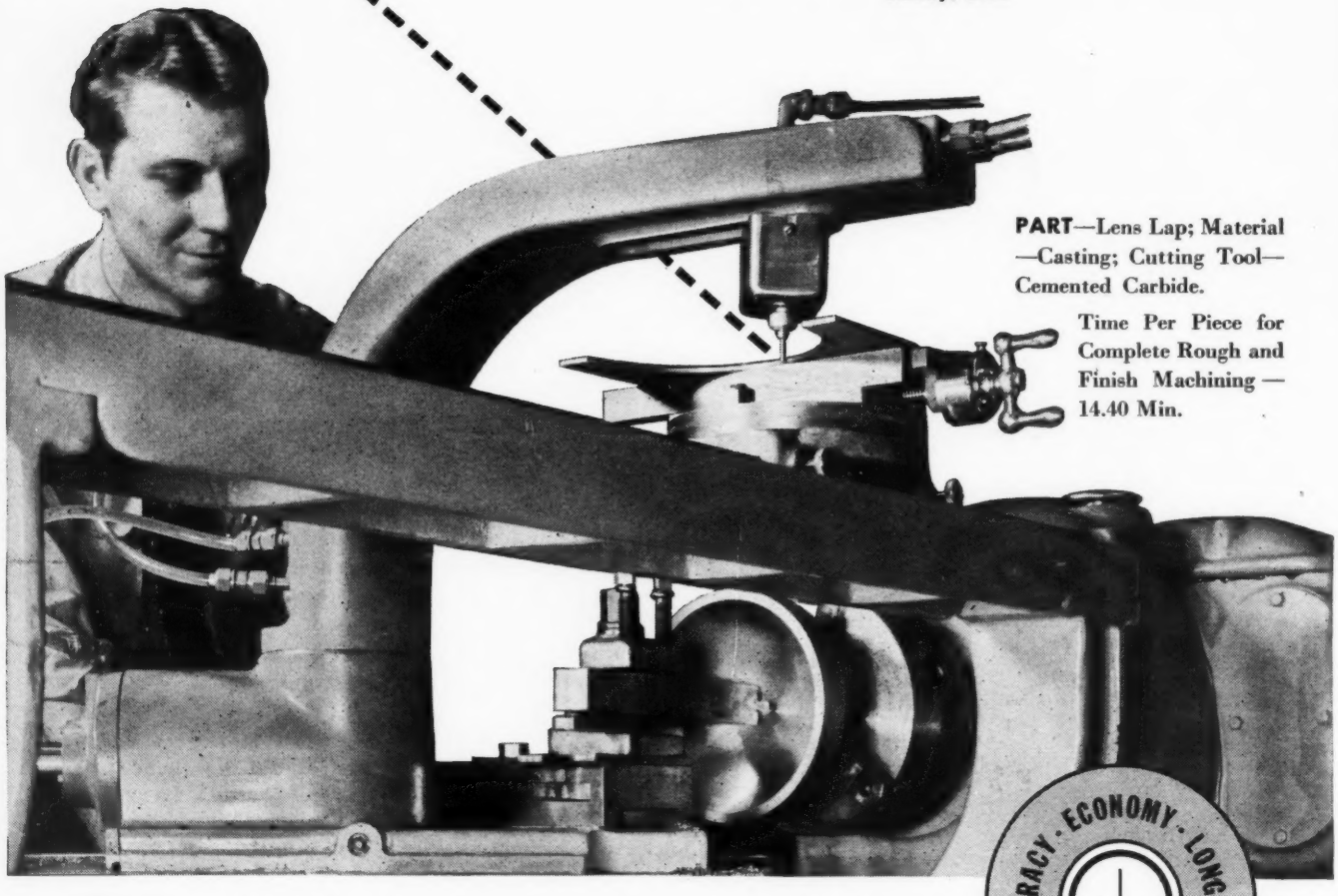
Molds, dies and similar contour boring jobs are a "natural" for the Monarch Air-Tracer.

With this new lathe attachment you can handle such work faster, for lower cost—and *more accurately*—because the cutting tool motion is stepless. Finish is better, tolerances are closer; the slightest change in template shape is instantly translated into slide feed.

On jobs where accuracy is all-important, this ability to follow contours closely pays off in dollars saved—by increased production, by closer tolerances, by fewer rejects. That's why the Air-Tracer was selected for the lens lap job illustrated; the final lens can be no more accurate than the machine that makes the lap. And the machine's accuracy isn't subject to human errors, either—the Air-Tracer's operation is continuous and automatic.

Whether you're boring or turning contours; machining tapers, step shafts or ordinary production lathe jobs, the Monarch Air-Tracer can save you time and money. Like more details? Ask for bulletin 2601.

THE MONARCH MACHINE TOOL COMPANY
Sidney, Ohio



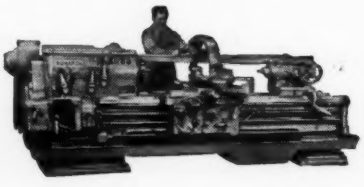
PART—Lens Lap; Material—Casting; Cutting Tool—Cemented Carbide.

Time Per Piece for Complete Rough and Finish Machining—14.40 Min.

FOR SPEED, ACCURACY AND FINISH, THE MONARCH AIR-TRACER*

1. **Stepless cutting-tool motion provides a superior continuous finish.**
2. **Setup times averaging five to ten minutes permit profitable use for a wide variety of small-lot production jobs.**
3. **Automatic yet versatile operation results in economical, accurate high production.**

Available exclusively on the new Monarch Lathes.



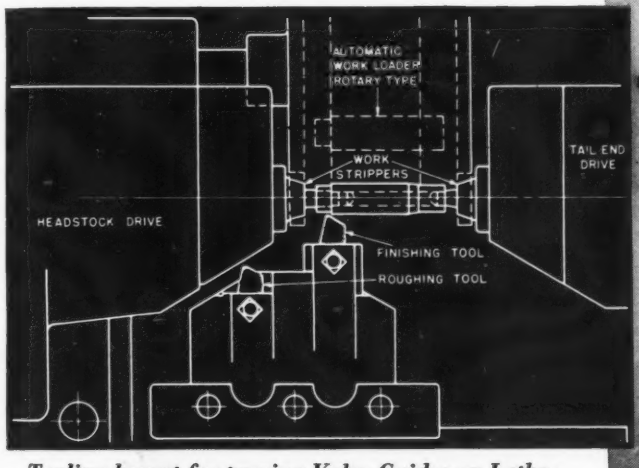
ACCURACY · ECONOMY · LONG LIFE

Monarch TURNING MACHINES

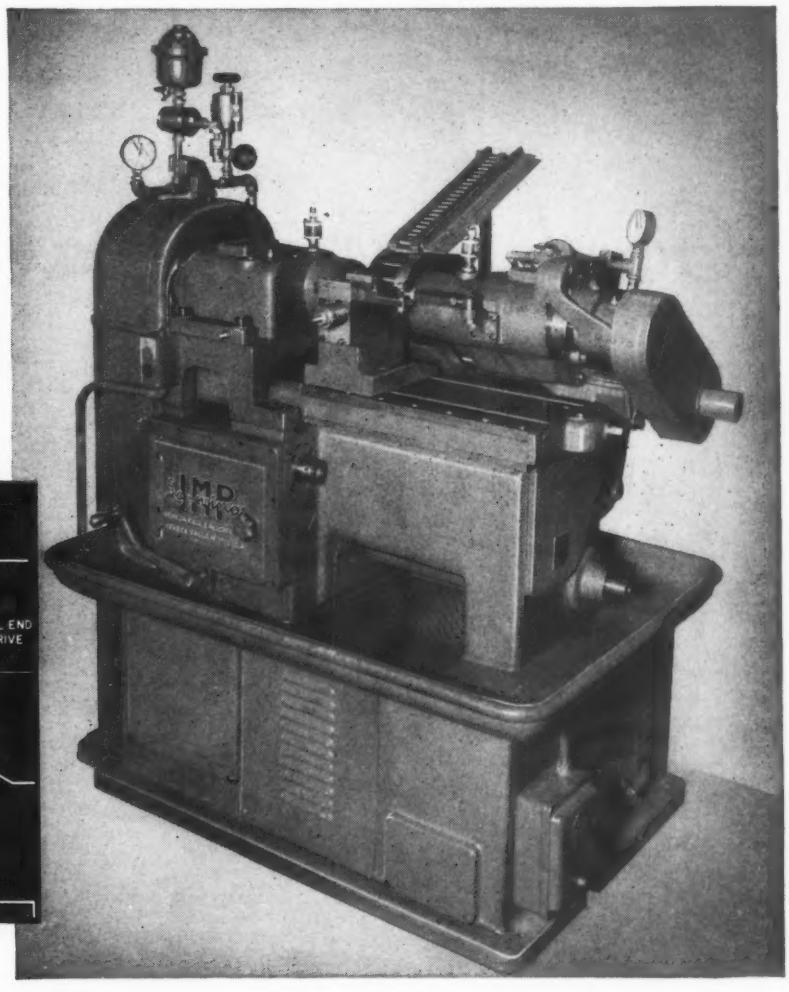
MACHINE OF THE MONTH

PREPARED BY THE SENECA FALLS MACHINE CO. "THE Lo-swing PEOPLE" SENECA FALLS, NEW YORK

COST ON VALVE GUIDE JOB REDUCED 73.6%



Tooling layout for turning Valve Guides on Lathe illustrated at right.



Problem: **To reduce cost of rough and finish turning valve guides.**

Solution: **The Lo-swing IMP Automatic Lathe was selected for this job and fitted with a new type Rotary loader and a complete new adaptation of tooling. This lathe is equipped with special revolving head and tailstock spindles and the advantage of this double-end drive is two-fold: 1—Since the piece is driven from both ends much coarser carriage feeds are possible, thereby considerably increasing production; and 2—inasmuch as both spindles are driven, there is no wear on the revolving centers.**

The machine is entirely automatic. Valve guides which have been previously bored to size are placed in a loading chute and fed by gravity into openings in the Rotary loader. The loader indexes the pieces to the proper position where they are automatically picked up by the continuously revolving spindles of both heads.

The OD is rough and finish turned in the same operation with two separate carbide tools, each having its individual feed. The finish turning tool begins cutting after the roughing tool has been relieved from the work, thereby assuring close concentricity between the bore and the finished diameter.

On high production jobs operator fatigue is an important item . . . automatic work handling permits full mechanical efficiency of equipment and reduces accident hazard.

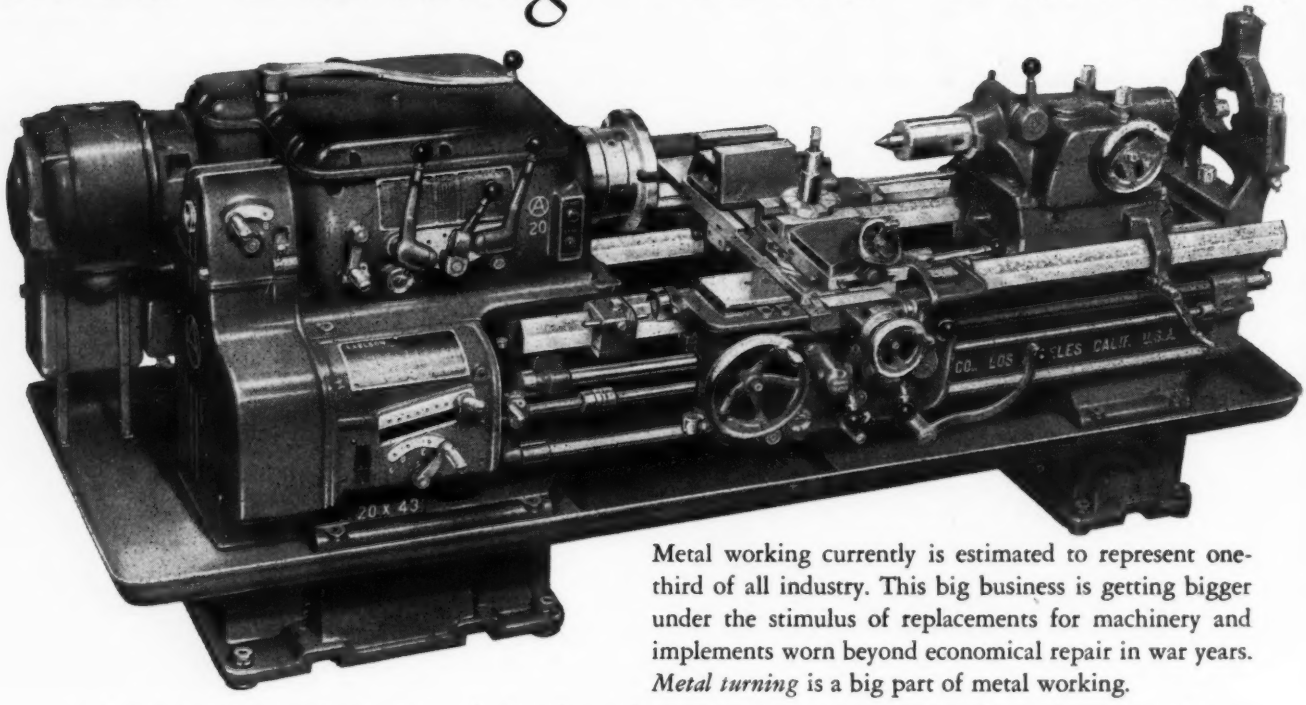
The Rotary type loader assures complete control over the fast revolving pieces eliminating danger to the operator and damage to the pieces which are completely stationary by the time they reach the discharge chute.

One operator attends two of these IMP Lathes and produces 73.6% more work per hour than was produced on the former single machine with hand loading. If *your* per piece costs are too high, maybe Seneca Falls can help you.

SENECA FALLS MACHINE CO., SENECA FALLS, N. Y.

PRODUCTION COSTS ARE LOWER WITH Lo-swing

Good Turning = Good Turnover



Axelson Lathes, of various lengths, are manufactured in 14, 16, 18, 20, 25 and 32-inch sizes. Also 20 and 25-inch hollow spindle "Oil Country" Lathes.

Metal working currently is estimated to represent one-third of all industry. This big business is getting bigger under the stimulus of replacements for machinery and implements worn beyond economical repair in war years. *Metal turning* is a big part of metal working.

Axelson heavy duty engine lathes insure uniformly good metal turning on light or heavy work. Speedy, precision lathe work from the fast, versatile Axelson 24-speed selective type geared head engine lathe will rapidly convert your metal turning orders into shipping orders. Shipments, too, will represent work of low per piece cost and minimum of rejects.

The moral of this is: "Good turning equals good turnover!"

AXELSON MANUFACTURING COMPANY

6160 S. Boyle Avenue, (Box 98, Vernon Station) Los Angeles 11, California
50 Church Street, New York City 7, N. Y.
3844 Walsh Street, St. Louis, Mo.

AXELSON *Lathes*

THERE IS NO ECONOMICAL SUBSTITUTE FOR QUALITY

DEPENDABLE FOR OVER A QUARTER CENTURY

An Open Letter

TO ALL WHO ARE INTERESTED IN DRILLING AND TAPPING SMALL PARTS

ETTCO TOOL CO., INC.

DRILL CHUCKS · TAPPING DEVICES
MULTIPLE HEADS

DETROIT CHICAGO

Ettco-Emrick

594 JOHNSON AVE.
BROOKLYN 6 · N.Y.

Dear Friends:

The Ettco-Emrick System of multiple spindle units represents a remarkable advance in the art of drilling and tapping SMALL PARTS.

The increased production and decreased costs over single spindle methods, make this System practically a "must" wherever such work is done.

The thousands of heads we made to meet the demands of war production, led us into new fields of design and accessories and extended the application of the System to a wide range of part shapes and hole requirements.

Fortunately, we Ettco folks have a supervisory staff of three Emricks, all journeyman toolmakers, all tool designers, all members of the firm and all vitally interested in creating better tools and methods for the high production of holes.

Specialized engineering is the backbone of our System. The method of handling any given part is as important in determining production as the use of multiple spindles. That's why we furnish - not just a multiple head with a number of spindles sticking out in the air - but a complete service, including work holder design - whether or not we make the work holding fixtures.

The fundaments of the System, and a few of the basic handling methods which influence the design of all multiple drilling and tapping units are covered in Bulletin 31.

Methods for handling your small parts have, most likely, already been worked out. All they need is a little good tool design to adapt them to your particular part shapes.

Sincerely yours,

Geo. B. Emrick
President

Robert G. Emrick
V.P. - Engineering

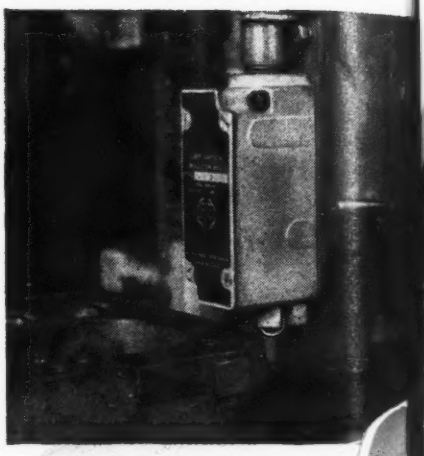
Melvin H. Emrick
V.P. - Production

WRITE FOR BULLETIN 31 TODAY

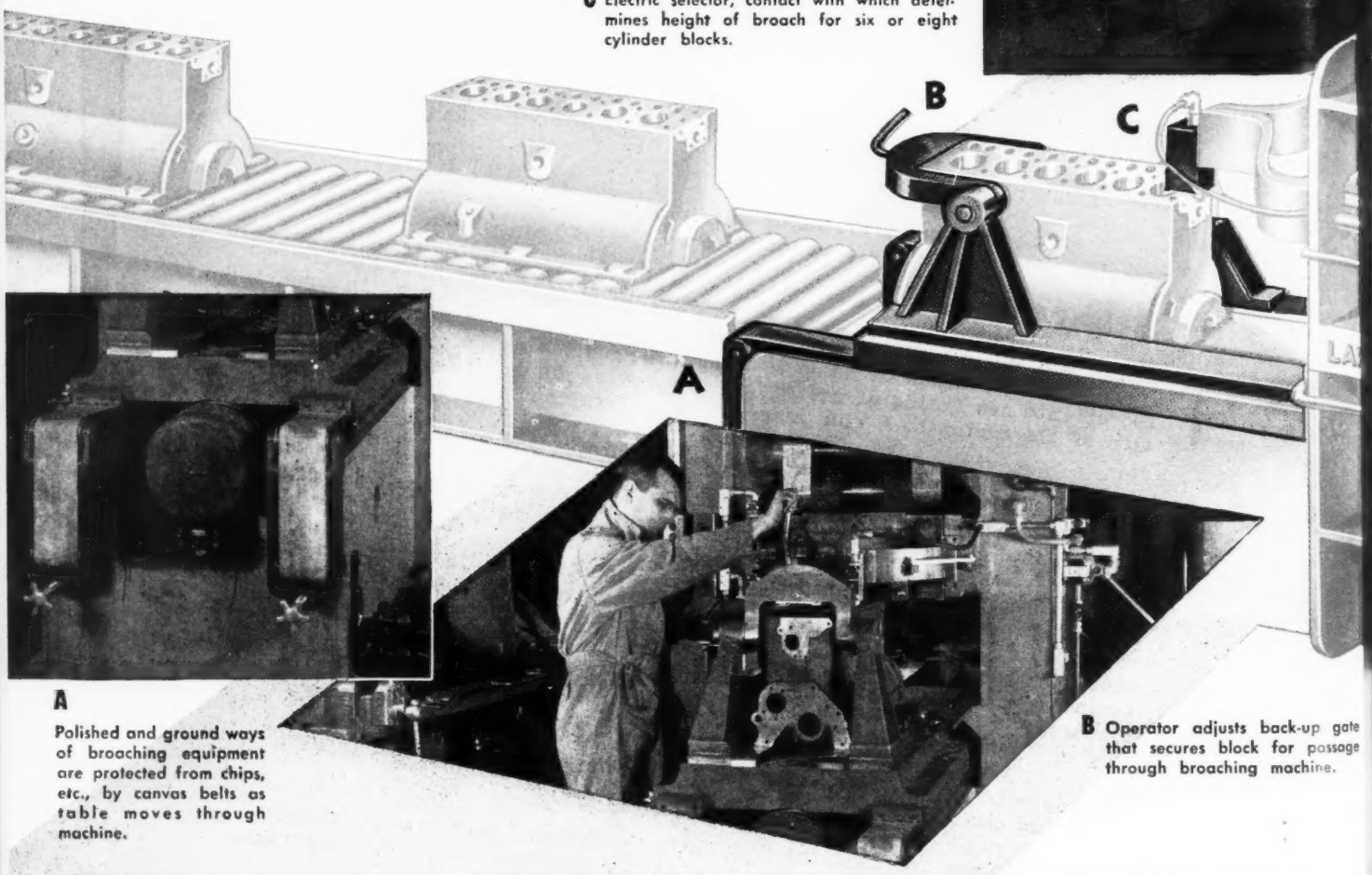
IN LINE WITH TOMORROW'S BETTER PRODUCTION!

The use of broaching means speedier, more economical production to meet the competitive demands of today's and tomorrow's markets. This method of metal removal is superior for both quantity and quality production, and keeps machining costs at rock bottom.

Broaching by Lapointe has meant savings of time, money and floor space in many instances. One of its most recent applications is in speeding the manufacture of motor cars. Investigate what broaching can mean to your future.



C Electric selector, contact with which determines height of broach for six or eight cylinder blocks.



A Polished and ground ways of broaching equipment are protected from chips, etc., by canvas belts as table moves through machine.

B Operator adjusts back-up gate that secures block for passage through broaching machine.

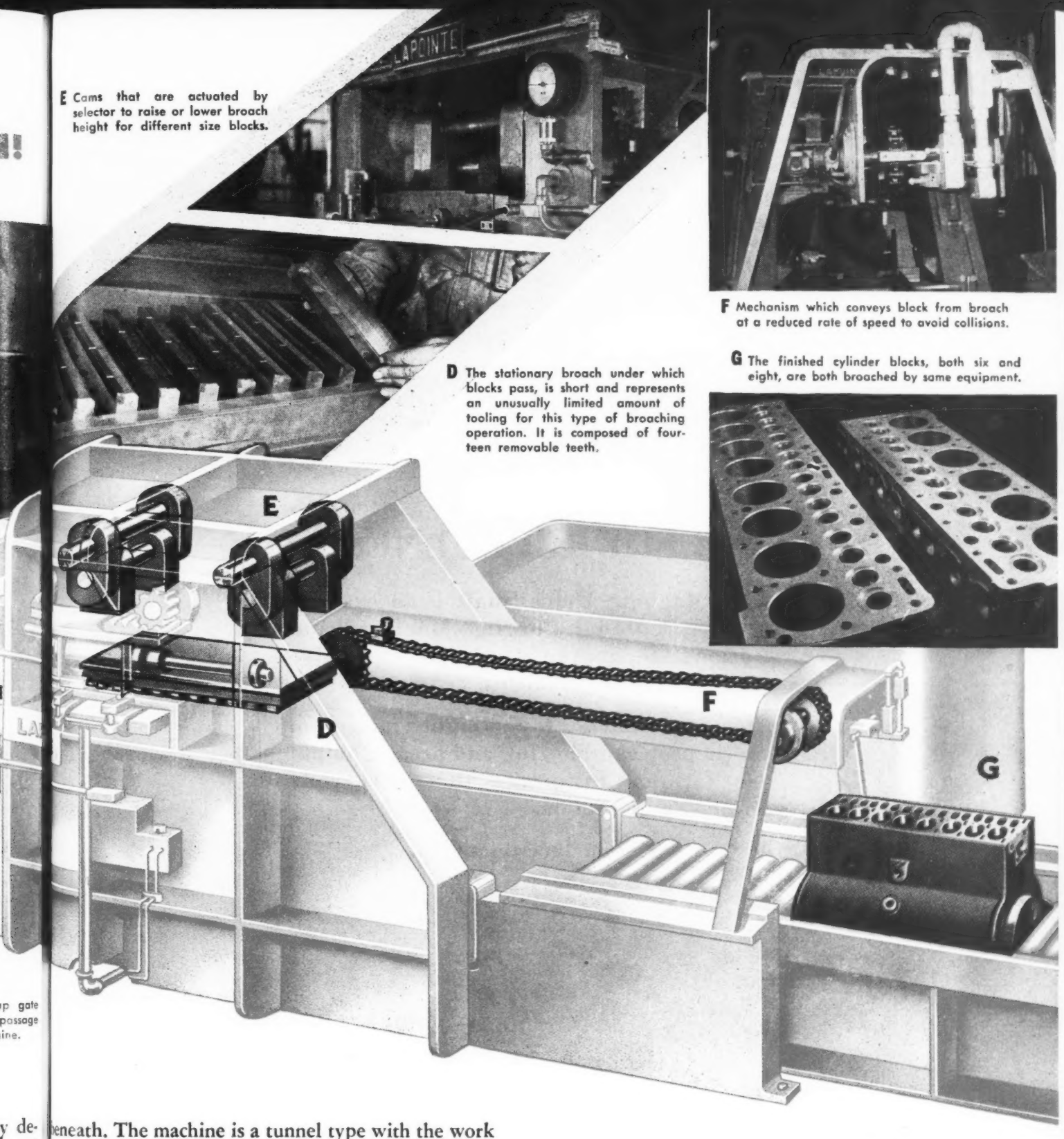
AS motor blocks pass along the production line for various operations their surfaces become marred, requiring a further surfacing before final assembly. In the plant of one of the nation's leading motor car builders, producing both six and eight cylinder engines, both sizes move along the conveyor line together. Since the six cylinder blocks are approximately 3/16 of an inch higher than those of eight cylinders, it was always necessary to separate the sizes for surfacing. This involved cumbersome handling with resulting loss of time.

Lapointe engineers solved this problem by designing broaching equipment that forms an integral part of the production line as shown. This equipment enabled the broach to properly position itself to surface either height blocks as they came along the line.

As a block comes to the broaching unit or conveyor (A) it is put into position and backed up by a manually operated gate (B) and brought into contact with an electrical control (C) which actuates cams (E) that automatically adjusts the height of the broach (D) to properly surface the block passing

THE WORLD'S OLDEST AND LARGEST MANUFACTURERS OF

WRITE TODAY FOR FULLY ILLUSTRATED "OPERATIONS MANUAL



E Cams that are actuated by selector to raise or lower broach height for different size blocks.

D The stationary broach under which blocks pass, is short and represents an unusually limited amount of tooling for this type of broaching operation. It is composed of fourteen removable teeth.

F Mechanism which conveys block from broach at a reduced rate of speed to avoid collisions.

G The finished cylinder blocks, both six and eight, are both broached by same equipment.

beneath. The machine is a tunnel type with the work passing under the broach which remains laterally stationary. The block is pulled through the equipment hydraulically and upon emerging is engaged by an automatic conveyor (F), moving at a reduced speed. Its speed is sufficiently lower than the cutting speed of the broaching machine to prevent damaging collision with the block that preceded it. The block (G) slides gently into place in the belt that will take it to the next operation.

The broaching is done by a special tunnel type, 20 ton 72 inch stroke machine.

THE Lapointe MACHINE TOOL COMPANY

HUDSON • MASSACHUSETTS

Branch Factory
EDGWARE, MIDDLESEX
ENGLAND

BROACHES AND BROACHING MACHINES

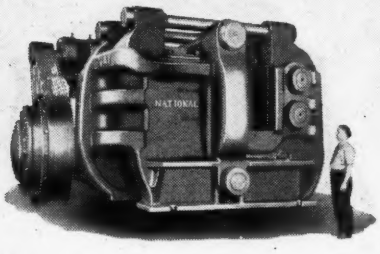
DESCRIBING, IN DETAIL, THE ENTIRE LINE OF LAPOINTE MACHINES

RESOURCEFULNESS

This Magneto Drive Shaft is an example of how National Forging Machines and National technique "team up" to solve difficult forging problems.

Close tolerances, low weight, minimum finish, proper grain flow and greater output are National advantages that merit your serious consideration.

May we help you investigate?



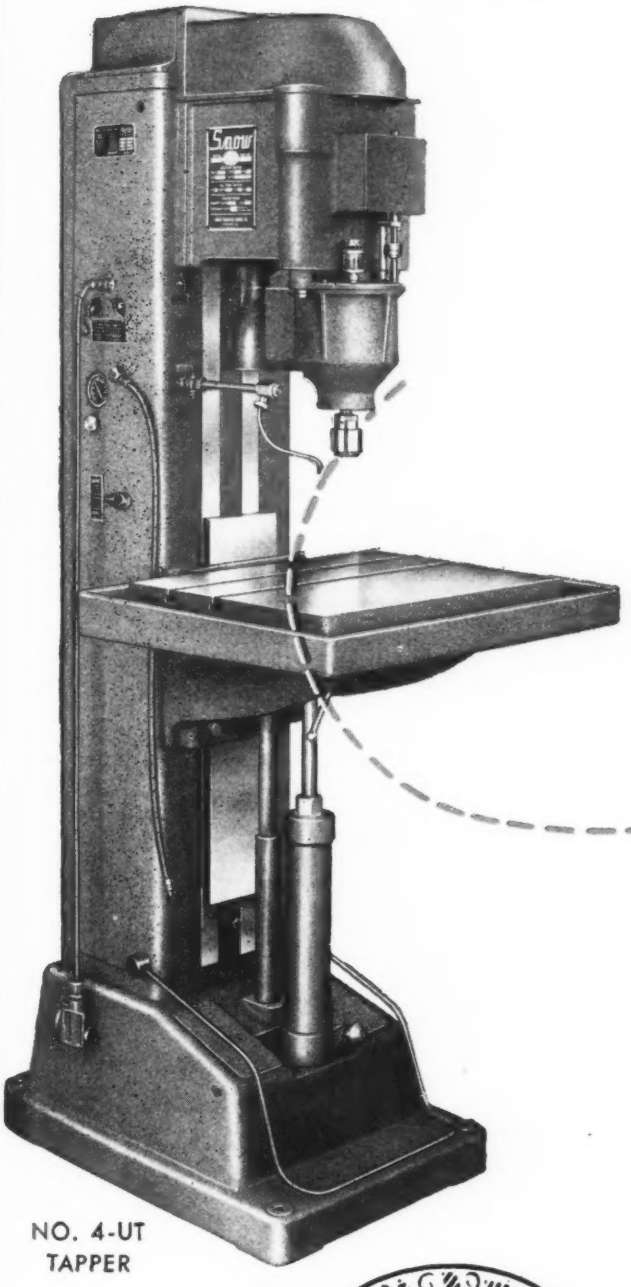
NATIONAL
MACHINERY COMPANY
TIFFIN, OHIO.

DESIGNERS AND BUILDERS OF
MODERN FORGING MACHINES—MAXIPRESSES—COLD HEADERS—AND BOLT, NUT, RIVET AND WIRE NAIL MACHINERY

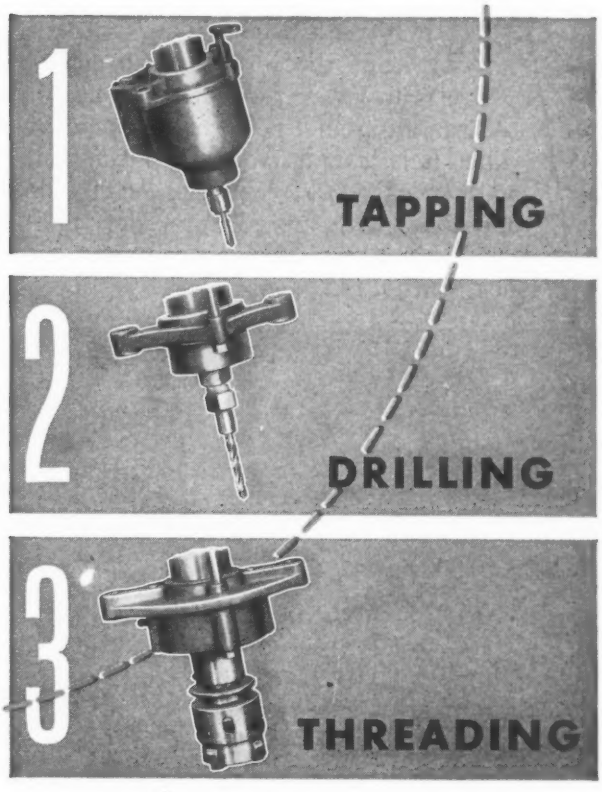
New York Detroit Chicago

AIR OPERATED • ELECTRICALLY CONTROLLED

FUNCTIONS *three* WAYS



NO. 4-UT
TAPPER



the *basic* SNOW AIR TOOL

Time-tested, quality-proven, thousands have been put into use in the past sixteen years. The Snow Air Tool — fundamental tool around which are built—the Snow Tapping Machine, the Snow Drilling Machine, the Snow Threading Machine.

Air operated—electrically controlled, it includes the latest in design. Quick-acting automatic holding fixtures are made fully automatic, semi-automatic or manually operated—all by the turn of a switch.

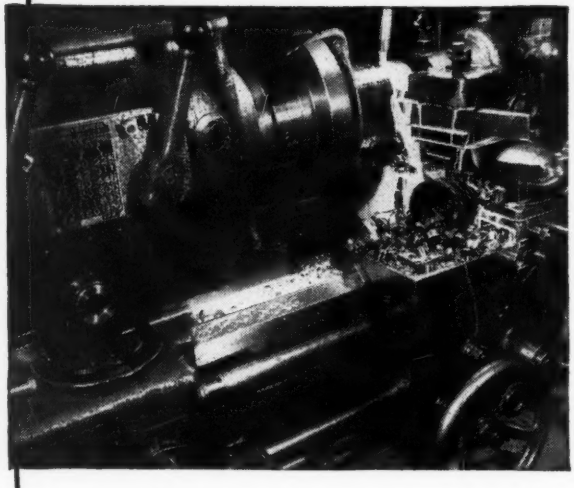
Send prints or sample parts for production estimates and for quotations. Or write for catalog.

Snow TOOL

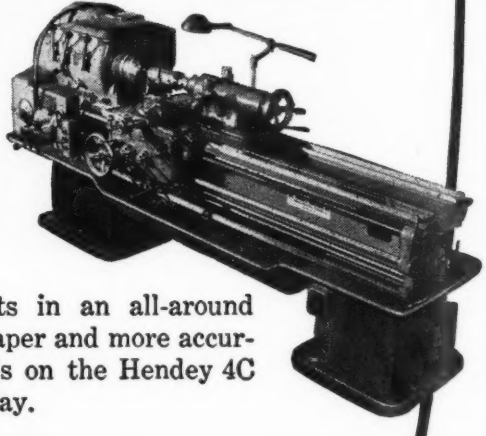
SNOW MANUFACTURING CO.
619 SOUTH CALIFORNIA AVENUE
CHICAGO 12 • ILLINOIS

OUTSTANDING AS AN ALL-AROUND PERFORMER
The 4C Will Lower Your Production Costs

Idle machines are especially expensive machines today when the surest way to gain a competitive advantage is to lower production costs. That's why the Hendey 4C, an all-around performer, should be on your production line. It is a manufacturing lathe that will handle a wide variety of work, being especially designed for long-run operation with speed, precision and economy, yet fully capable of quick change-over to accommodate many different short run jobs.



No effort has been spared to make the 4C a versatile, low-cost producer. A twelve-speed geared headstock, plus a unique change gear train, provides a great number of feeds and speeds to enable the most efficient use of the most modern metal cutting tools. Starting and stopping has been made a split-second operation by virtue of a special multiple disc clutch and cone brake to cut "down time" to a minimum. Accurate indexing for cutting multiple threads is provided by precise graduations engraved on the spindle collar. The apron design allows for taper turning up to 45° and, when complemented by the taper attachment, this angle can be increased to 48½°.



Construction, too, is outstanding. Selected materials are used throughout, and every part and assembly, plus the finished machine, is thoroughly checked for quality and accuracy. For instance every lead screw used on a Hendey 4C must test out to ± .001" per foot of lead.

Such a combination of features naturally results in an all-around performer—a machine that will produce faster, cheaper and more accurately. That's why it will pay you to get full details on the Hendey 4C manufacturing lathe. Write for the free catalog today.

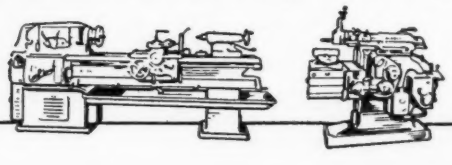
The Hendey Machine Company

Hendey

Main Office and Plant — Torrington, Connecticut

Offices — N. Y., Chicago, Boston, Detroit, Rochester, Los Angeles, San Francisco

Representatives in — Philadelphia, Cleveland, Pittsburgh



TOOL ROOM LATHES
12" - 14" - 16" - 18" - 20"

SHAPERS
12" - 16" - 20"

SUPER *Carbide Tipped* SPECIAL TOOLS

SUPER *Carbide Tipped* STANDARD TOOLS

EJECTOR-TYPE TOOLS
DRILLS
REAMERS
SPOTFACERS
FORM TOOLS
WEAR PARTS
BORING TOOLS
MILLING CUTTERS
SHAVING TOOLS
CENTERS
GRINDER RESTS
COUNTERBORES

Get the benefit of *Super's* many years of experience, solely in the field of Carbide Tipped Tools.

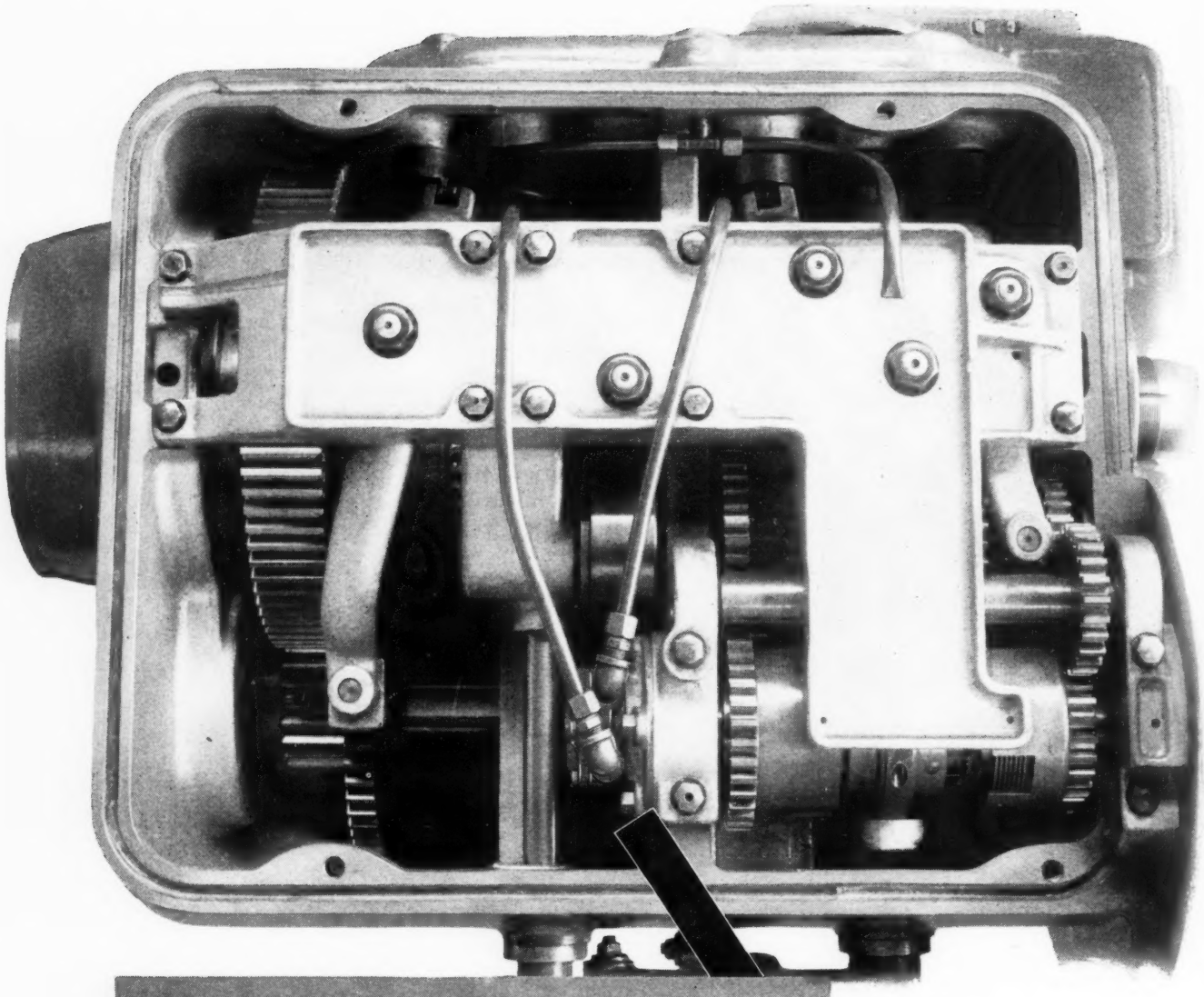
It will pay you dividends.

Special Tools to your specifications — Carbide Tipped — Solid Carbide—all produced by *Super* skilled engineers and craftsmen.

SUPER TOOL COMPANY

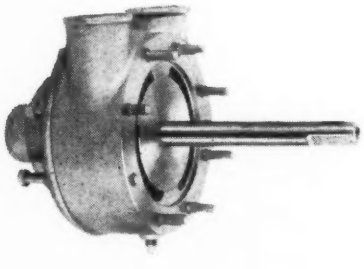
Carbide Tipped Tools

21650 Hoover Road, Detroit 13, Michigan ★ 5210 San Fernando Road, Glendale 3, California



CLOSE QUARTERS CALL FOR TUTHILL *Stripped* PUMPS

Where space is at a premium, Tuthill Stripped Pumps provide the practical answer. Built directly into the design of your machine, these internal-gear rotary pumps save space, reduce costs and improve appearance. Two types are available. Model S is furnished without mounting bracket. Model SA provides pumping elements only, for even greater space economy. Either is ideal for lubrication, coolant, hydraulic and liquid transfer service. Capacities up to 200 g.p.m. in wide pressure ranges. Stripped pumps also available in the automatic reversing type. Write for Tuthill Stripped Pump bulletin.



TUTHILL PUMP COMPANY

939 East 95th Street • Chicago 19, Illinois

CHOCK-FULL OF INFORMATION

for you.

44 PAGES profusely illustrated with all types of Farquhar production presses, including heavy duty housing type presses, column type presses, gap type presses, straightening presses, all purpose presses, moulding presses, extrusion presses and miscellaneous presses. Capacities, 3 to 7200 tons.

Farquhar precision built hydraulic presses are turning out better, faster work at less cost in thousands of plants all over the world. You can increase profits with a Farquhar Press.

Name the job . . . Farquhar builds the press you need.

Write today for complete specifications and your copy of the new 1947 Hydraulic Press Catalog.

CLIP AND MAIL TODAY

15

A. B. FARQUHAR COMPANY
York, Pennsylvania

Gentlemen: Please send me, without obligation, the new 1947 Farquhar Hydraulic Press Catalog.

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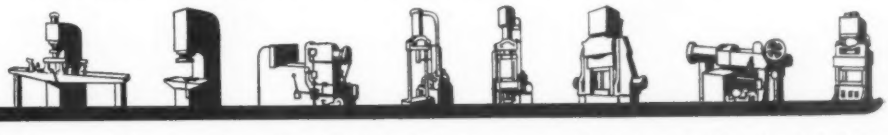
HYDRAULIC PRODUCTION PRESSES

MATERIAL HANDLING CONVEYORS • SPECIAL MACHINERY

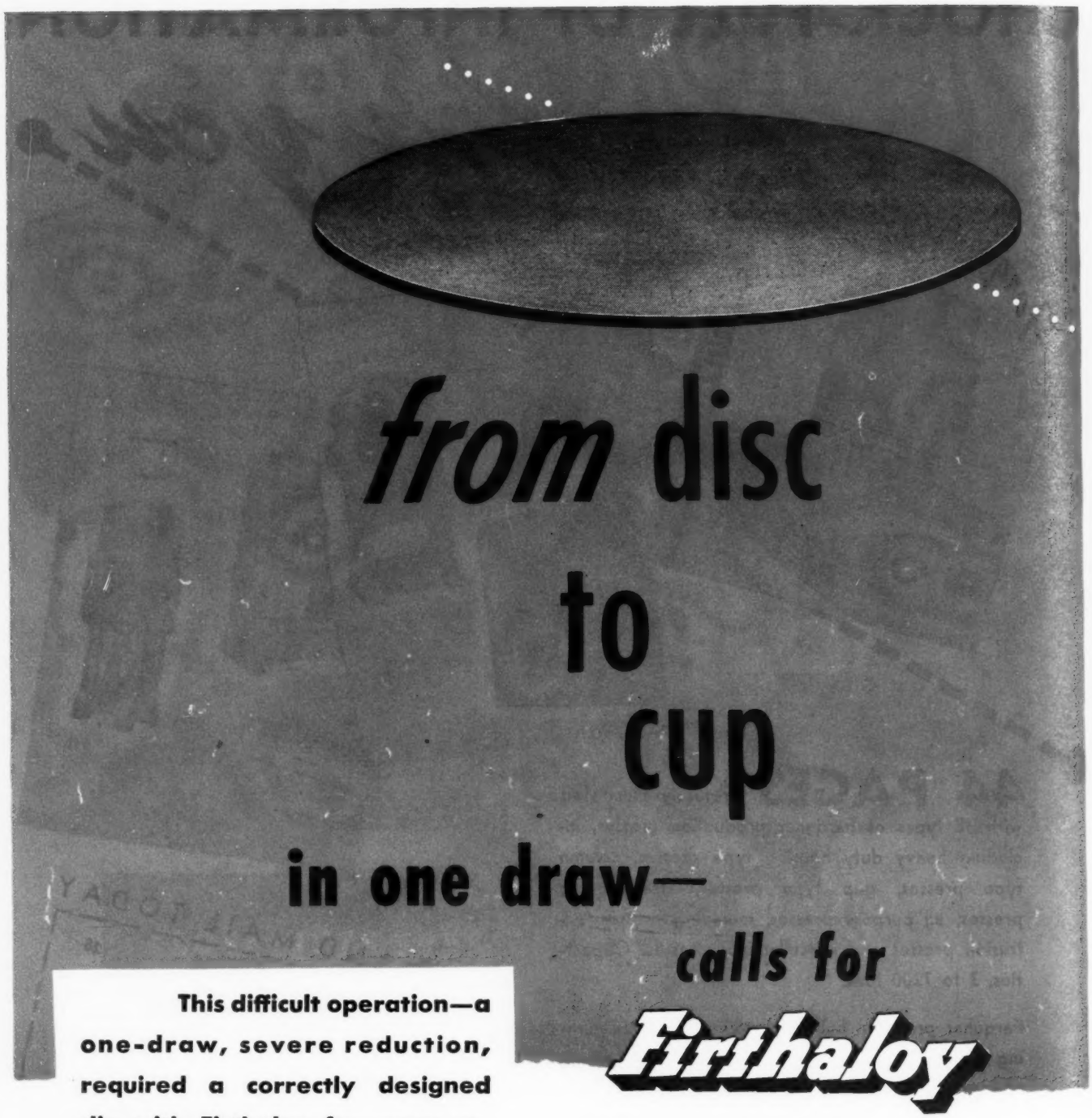
Farquhar



HYDRAULIC PRESS DIVISION

A. B. FARQUHAR COMPANY

1504 DUKE ST. YORK, PA.



from disc to cup

in one draw—

calls for Firthaloy QUALITY DIES!

This difficult operation—a one-draw, severe reduction, required a correctly designed die with Firthaloy for wear resistance in the hole, and hardened top face for wear resistance against wrinkling.

FIRTHALOY

Call **Firth Sterling**

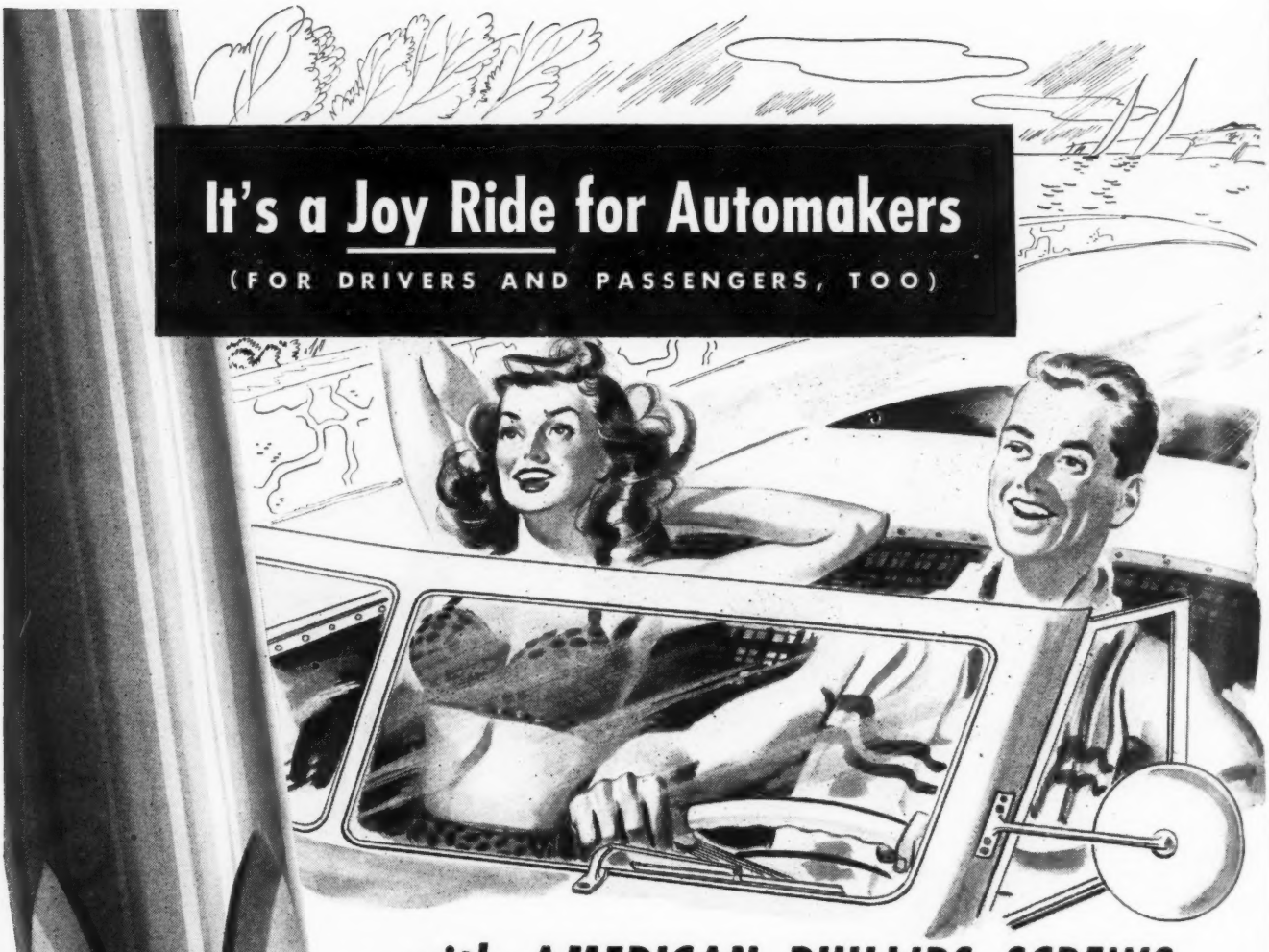
STEEL & CARBIDE CORPORATION

McKEESPORT, PA. • NEW YORK • HARTFORD • PHILADELPHIA • PITTSBURGH • CLEVELAND • DAYTON • DETROIT • CHICAGO • LOS ANGELES

There's more to a good deep drawing die than a carbide insert in a steel casing. Firthaloy engineering skill based on past experience in the deep-drawing field; correct design based on established practice; proper selection of materials; accurate specifications to meet the individual needs of the case . . . are reasons why FIRTHALOY DIES assure size control, surface finish, trouble-free operation, long life and low die cost per piece.

It's a Joy Ride for Automakers

(FOR DRIVERS AND PASSENGERS, TOO)



...with AMERICAN PHILLIPS SCREWS

that keep brakes on costs, protect performance, speed up sales

"STEP ON THE GAS" IN PRODUCTION! Why *put up* with slow, slip-and-slash, "horse-and-buggy" fastening methods when AMERICAN PHILLIPS SCREWS can be driven at TOP SPEED. But speed is only part of the story. American Phillips Screws can't be fumbled, fingers can't be mangled, work can't be wrecked. And driving is automatically straight. So . . . TOTAL TIME-SAVINGS MOUNT AS HIGH AS 50%.

"STEP ON THE GAS" IN PROMOTION! American Phillips Screws give car, boat, appliance (or whatever you make), a "classy chassis" that means more sales thru more *show*manship! Clothes and hose can't snag. And resistance to vibration makes another talking point. There's an American Phillips Screw in any type or metal which will win these production and promotion "extras" for you, your distributors and dealers.

4-WINGED DRIVER CAN'T SLIP OUT OF PHILLIPS TAPERED RECESS

AMERICAN SCREW COMPANY, PROVIDENCE 1, RHODE ISLAND

Chicago 11: 589 E. Illinois Street *Detroit 2:* 502 Stephenson Building

AMERICAN PHILLIPS *Screws*

ALL TYPES

ALL METALS: Steel, Brass, Bronze, Stainless Steel, Aluminum, Monel, Everdur (silicon bronze)

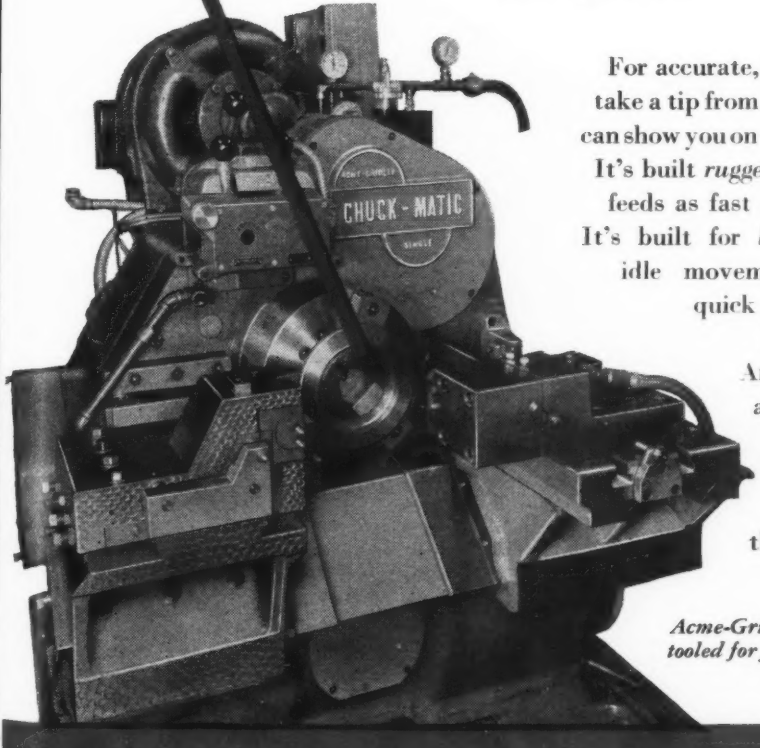
Diam. SAE 4620 steel
rged, rear axle drive
ar blank.

1ST OPERATION—
Taper face, counterbore
and face bottom. Ma-
chine Time: 43 seconds.

2ND OPERATION—
Face, form angle, rough
and finish bore. Machine
Time: 60 seconds.

CHUCK-MATIC PRODUCTION

Two Operations—1 Min. 43 Sec.—Complete



For accurate, high-speed production of chucking jobs take a tip from this typical case study—one of many we can show you on the new Acme-Gridley 12″ Chuck-Matic. It's built *rugged*—and *powerful*—to deliver speeds and feeds as fast as carbide-tipped tools can take it. It's built for *high production*—with a minimum of idle movement and plenty of accessibility for quick setups, easy loading, easy adjustment. It's built *compact*—for space saving. And because it's *easy to operate*, one operator (he needn't be highly skilled, either) can run as many as four machines. That's why we think you'll be interested in the complete details on the Chuck-Matic. Ask for bulletin SC-46.

Acme-Gridley 12″ Single Spindle Chuck-Matic tooled for first operation on rear axle drive gear.

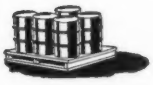
The NATIONAL ACME CO.

170 EAST 131st STREET • CLEVELAND 8, OHIO

SEE THIS EQUIPMENT
DEMONSTRATED
Booth 628
Machine Tool Show
CHICAGO—SEPT. 17-26

First, INDUSTRIAL TRUCKS . . .

Then, PALLETIZED UNIT LOADS . . .



Now, STANDARDIZED

POW-R-TRUCK ELEVATORS!

This latest addition to the Otis line of standardized freight elevators—previously available only as a custom-built "special"—adds *floor-to-floor travel* to the many other time- and labor-saving advantages of industrial trucks . . . effectively increasing their usability.

With a Pow-R-Truck elevator an industrial truck becomes *completely* mobile, free to take unit loads direct to destination on any floor. No productive time need be lost in loading, picking up or re-handling.

Pow-R-Truck elevators are designed (1) to withstand off-balance loading and impact loading, (2) to carry both truck and pay-load, when required, and (3) are built to Otis standards of performance and *safety*.

If you use, or expect to use power trucks, an Otis Pow-R-Truck elevator can be the vital link in your materials-handling system.

For illustrated folder please address Otis Elevator Company, 260 Eleventh Ave., New York 1, N. Y.

Otis ELEVATOR COMPANY
OFFICES IN ALL PRINCIPAL CITIES

VERY QUICK DELIVERY

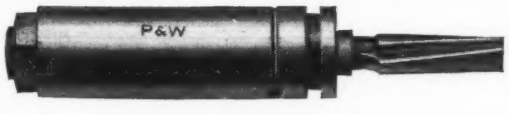
of STUB Screw Machine REAMERS UNDER THIS PRATT & WHITNEY SYSTEM

Need stub screw machine reamers of definite decimal sizes—but *FAST?* They're 90% ready for you at P&W. And you get *very quick delivery.* Here's how:

Hardened, ready-to-grind blanks are carried in stock. Your order comes in. We draw the proper size blanks from stock, grind them to your specified size — and SHIP PROMPTLY.

Costs are low because they're mass-produced. Performance is tops because they're P&W engineered of high-speed steel for toughness and free cutting. Every reamer receives the time-tested diamond blue treatment for maximum wear life. Stock reamers are left-hand spiral. Right hand, straight-fluted and special-dimension reamers can be supplied to order at reasonable prices and deliveries.

Cut costs. Standardize on P&W Stub Reamers. Get the facts. Ask your P&W Engineer, or use the coupon for complete details.



EFFICIENT REAMER HOLDER

You ream accurately within close tolerances with this holder and P&W Stub Screw Machine Reamers.

Delicate alignment is possible with the well-balanced floating feature. Use individual bodies for each shank diameter or bushing adapters for a single body to fit all Stub Reamers.

Pratt & Whitney

Division Niles-Bement-Pond Company

West Hartford 1, Connecticut

PRATT & WHITNEY
Division Niles-Bement-Pond Company
West Hartford 1, Connecticut

Please rush literature describing P&W Stub Screw Machine Reamers.

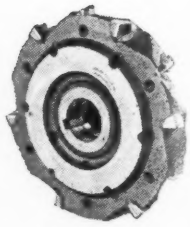
*Name*_____

*Title*_____

*Company*_____

*Address*_____

Specials ARE OUR Specialty



The right tool for the job often means a special tool and that usually means an expensive tool. But **not** when you come to Lovejoy, because specials are our specialty—and we offer something extra special when it comes to designing and making them.

Part of that extra-special something is the fact that all our custom-made tools use a majority of **standard** parts. They are built around the famous Lovejoy positive-blade locking device and use Lovejoy interchangeable blades. This means lower initial cost, longer blade life, faster, more accurate production and simpler maintenance. The rest is made up of our nearly thirty years of experience in designing and making all types of inserted-cutter tools and a nationwide service organization that's of real value to owners of Lovejoy special tools, because Lovejoy specials have so many standard parts.

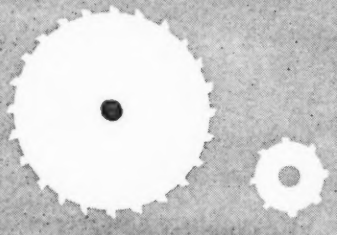
For a few examples of Lovejoy specials, see the illustrations above. They include a rugged dovetail cutter, two face mills—one 24" in diameter, the other 2½" in diameter, a special boring head, and a husky slotting cutter. All use interchangeable carbide-tipped Lovejoy blades.

If your work requires special cutters, you can make no better move than to send your problem to Lovejoy, because specials are our specialty.

ALWAYS SPECIFY LOVEJOY

DESIGN

A complete engineering service, backed by an experienced staff, is at your service to make recommendations and design special cutters.



RANGE

Hundreds of sizes, dozens of models to meet every requirement, regardless of machines used or materials to be cut.

SERVICE

Even special tools use standard parts which are stocked by us. There are 20 Lovejoy service centers throughout the U.S.A. — there is one near you.

30 YEARS' SATISFACTION

Nearly 30 years' continuous experience making milling cutters and other "Positive-Locking" tools. Our first customers are still buying our tools.

LOVEJOY TOOL COMPANY, INC.
SPRINGFIELD, VERMONT, U. S. A.

ADAPTABILITY

to work small or large forgings *(limited only by the clear working space above and around anvil)*.

Lobdell-Nazel Forging Hammers *operate at the push of a switch. Force of blow* (light, medium or heavy) *is easily varied* while operator maintains the rhythmic cadence of *constant stroke frequency*.

This coordinated "working tempo" increases production of close tolerance forgings, reduces reheats, assures more uniform forgings, lowers machining costs.

An *exclusive* feature of Types 1B, 2B and 3B only *(anvil and base cast in one piece of steel)* assures accurate alignment of dies, eliminates a costly, special, deep, concrete foundation, simplifies installation and relocation. Types 2B and 3B are *now* available for early delivery.

EXCLUSIVE DEALERS

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2641 University Ave.
St. Paul 4, Minn.

Blackman & Nuetzell Machinery Co.
3713 Washington Avenue
St. Louis 8, Missouri

Carey Machinery & Supply Co., Inc.
119-121 E. Lombard Street
Baltimore 2, Maryland

General Machinery Corporation
140 Federal Street
Boston 10, Massachusetts

Harron Rickard & McCone Co. of Northern California
2070 Bryant Street
San Francisco 10, California

Harron Rickard & McCone Co. of Southern California
3850 Santa Fe Avenue
Los Angeles 11, California

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Cincinnati 2, Ohio

George D. Miller Co.
Rockefeller Building
Cleveland, Ohio

The Mine & Smelter Supply Co.
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Branch Office
P. O. Box 1162, El Paso, Texas

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P. O. Box 7928 Dormont
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The Henry Walke Company, Inc.
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Houston, Texas

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Birmingham 2, Alabama

Write for Hammer Book about LOBDELL-NAZEL, BY FAR, *the most widely used air-actuated, motor-driven forging hammers in the world.*

LOBDELL
NAZEL
FORGING HAMMERS

PAPER MILL MACHINERY • DILL "T-H" SLOTTERS • ROLLS FOR ALL INDUSTRIES

LOBDELL COMPANY ESTABLISHED 1836 WILMINGTON 99, DEL.

Let Us Start Your Finish Right!

A Lowe Brothers "Finishing Engineer" helped this *Building Supply Manufacturer* develop a complete finishing system!

What finish is best adapted to your product? What finishing methods are most suitable for your particular requirements? The experience and knowledge of the Lowe Brothers "Finishing Engineer" are available to help you find the answer to these . . . and many other questions about finishing that may be of interest to you.

One prominent manufacturer of metal tiles recently asked a Lowe Brothers "Finishing Engineer" to help in the development of a complete finishing operation to meet the special requirements of their product. After careful study, basic finishing system recommendations were made which resulted in the installation of an automatic conveyor line; a series of four cleaning dips and rinses; manual spraying in a special pressurized spray booth to eliminate dirt; and an infra-red baking unit. These recommendations were based on experience and the result was a well-rounded, efficient finishing system from start to "finish"!

This is just another example of the complete finishing service offered by the Lowe Brothers "Finishing Engineer." Perhaps he can help you, too. Whether you are a Lowe Brothers customer or not, he will be glad to study your finishing operation and may be able to make suggestions for improvements if they are necessary. And remember, there is no charge or obligation. Our "Finishing Engineer" is trained to serve you, not "sell" you. The Lowe Brothers Company, Dayton, O.

Lowe Brothers
FINISHES FOR INDUSTRY

SPECIFY G. S. SMALL GEARS FOR

1 CORRECT DESIGN
2 EXTREME PRECISION
3 UNIFORM QUALITY
4 DEPENDABLE PERFORMANCE
5 ECONOMICAL PRODUCTION
6 EFFICIENT SERVICE

SEND FOR OUR 4-PAGE BULLETIN

The G.S. Bulletin describes many different types and applications of G.S. Small Gears. Please ask for a copy on company stationery.

If there was ever a place to get *better* Small Gears, *this is it!* . . and for very good reasons, too. Throughout a quarter century of intensive specialization . . years of constant research and progress . . we've developed the art of engineering and producing Fractional Horsepower Gears to a degree of perfection generally considered impossible a short time ago.

When you specify "G.S." for instance, you employ extensive facilities and an experienced organization of Small Gear Craftsmen. They can lend you valuable aid, not only in turning out *uniform* production runs, but also in establishing the *one* best design for the job the gear has to do. So . . whatever the problem . . put it up to a G.S. Engineer! Let him help you achieve the finest performance you've ever known from a Fractional Horsepower Gear! Ideas, information and cost estimates are yours for the asking. Will you write or phone us today?

GEAR Specialties

Spurs • Spirals • Helicals • Bevels • Internals • Worm Gearing • Racks • Thread Grinding

2635 WEST MEDILL AVENUE • CHICAGO 47, ILLINOIS

MEMBER OF AGMA

WORLD'S LARGEST EXCLUSIVE MANUFACTURERS OF FRACTIONAL HORSEPOWER GEARS

WHATEVER YOU DO . . .

WINTER ENGINEERS Can Help Solve Your TAPPING PROBLEMS

The services of WINTER Engineers are easily available to you for the solution of your tapping problems. Whatever type of work you do, wherever you may be, if you have a tough threading job, a call to your local WINTER distributor will quickly bring the assistance of all WINTER engineering facilities. These include carefully collected and classified case histories on almost every possible type of threaded work.

Leadership **BUILDS ON** *Craftsmanship*

Craftsmanship of the highest order always has been employed in the manufacture of WINTER Taps.

YOUR LOCAL DISTRIBUTOR carries a complete stock of WINTER Taps on his shelves —as close to your tapping problems as the telephone on your desk.

Winter Brothers COMPANY

WRENTHAM, MASS. and ROCHESTER, MICH. • Distributors in Principal Cities

A Division of the National Twist Drill and Tool Company • Branch Stores: San Francisco, Chicago, Detroit

FROM COAST TO COAST

There is a NATIONAL CUTTING TOOL Engineer To Serve You

NATIONAL Service Engineers are strategically located in every section of the country. Factory training and years of experience make them specialists in dealing with all types of problems concerning cutting tools and their uses. One of these engineers is nearby to serve you whenever you need him. His counsel and assistance are at your disposal without obligation. Just call the NATIONAL distributor in your locality.

Craftsmanship INSURES *Quality*

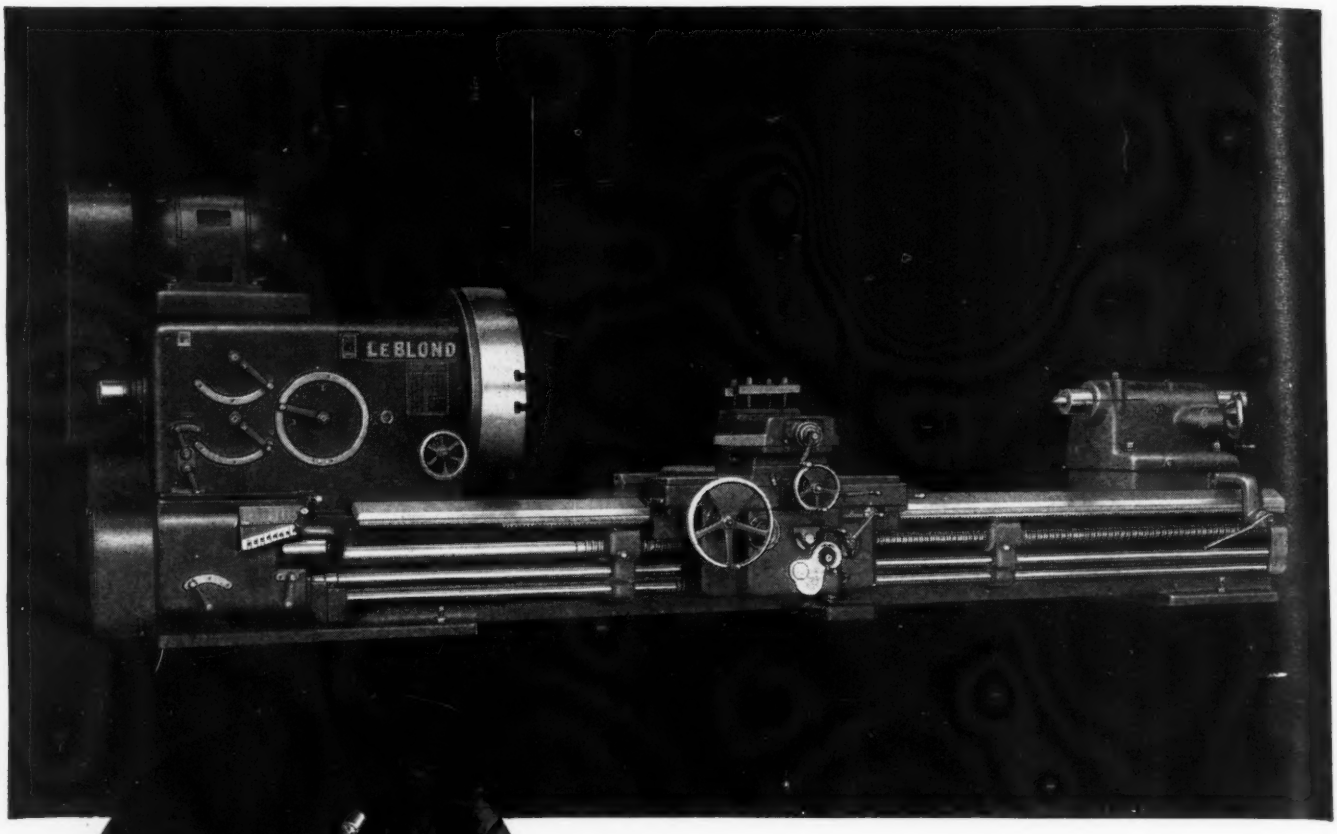
LEADING DISTRIBUTORS EVERYWHERE offer complete stocks of NATIONAL Cutting Tools. Call them for cutting tools or any other staple industrial product.

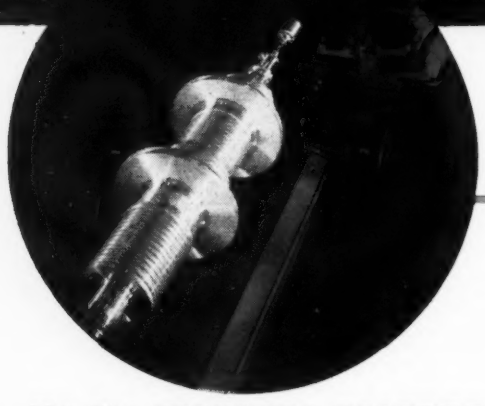
The skill and facilities to make NATIONAL Tools the best you can buy are supplied at NATIONAL'S great new plant in Rochester, Michigan.

NATIONAL TWIST DRILL AND TOOL COMPANY

ROCHESTER, MICHIGAN, U. S. A. Tap and Die Division — Winter Bros. Co.

Distributors in Principal Cities • Factory Branches: New York • Chicago • Detroit • Cleveland • San Francisco





Giants for Work . . .

THE 40" AND 50" LEBLOND HEAVY DUTY ENGINE LATHES

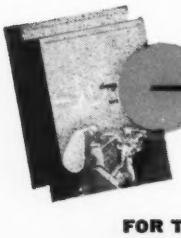
40"-50" STANDARD FEATURES

- Feed box totally enclosed, lubricated automatically.
- 27-speed geared headstock.
- Periphery-driven face plate . . . 18 speeds.
- Flame hardened steel bed ways.
- Power rapid traverse moves carriage electrically.
- Power angular feed to compound rest.
- One-piece apron with positive jaw feed clutch, lubricated automatically.
- Apron electric control starts, stops, and reverses spindle.
- Thrust lock tailstock with worm and rack construction.

Big lathes for big jobs. Gigantic in size, yet these powerful lathes are extremely easy to operate . . . produce the accuracy associated with much smaller LeBlond lathes. They present the capacity, power, and stability necessary for turning work of huge proportions. Smartly engineered, ruggedly constructed, they will hold their dependable accuracy for years. Send for complete information today.

THE R. K. LEBLOND MACHINE TOOL COMPANY, CINCINNATI 8, OHIO
LARGEST MANUFACTURER OF A COMPLETE LINE OF LATHES

New York 6, Singer Bldg., 149 Broadway, COrtlandt 7-6621-2-3.
Chicago 6, 20 N. Wacker Drive, STA 5561.
Philadelphia 40, 3701 N. Broad St., SAgamore 2-5900



Get your copies

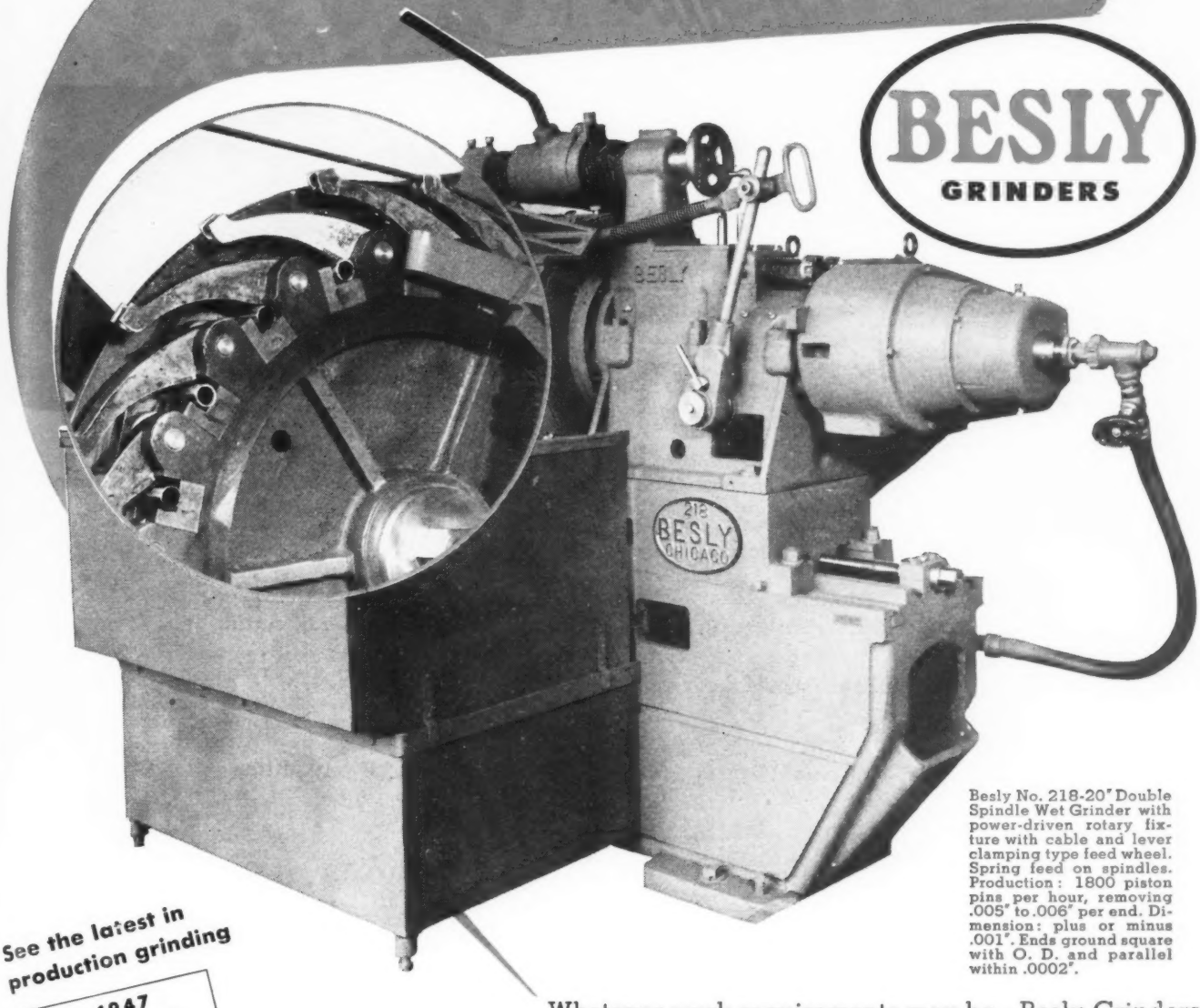
of new illustrated bulletins describing the 40" and 50" LeBlond Heavy Duty Engine Lathes. Write Dept. HD-468.

FOR THE VERY LATEST in modern lathes, be sure to see our complete line in action at the MACHINE TOOL SHOW, DODGE CHICAGO PLANT, September 17-26. You're always welcome at the LeBlond booth—conveniently located close to the main entrance.

© 1947, LEBlond

LEBLOND

Designed FOR SIMPLIFIED TOOLING



Besly No. 218-20" Double Spindle Wet Grinder with power-driven rotary fixture with cable and lever clamping type feed wheel. Spring feed on spindles. Production: 1800 piston pins per hour, removing .005" to .006" per end. Dimension: plus or minus .001". Ends ground square with O. D. and parallel within .0002".

See the latest in production grinding

1947 MACHINE TOOL SHOW
CHICAGO SEPT 17-26

BOOTH NUMBERS
...275
...276
...277

Whatever work requirements may be—Besly Grinders provide maximum time-saving in tooling set-ups. A practical example is this typical 218-20" Besly Double Spindle Wet Grinder with rotary fixture arranged for grinding piston pins.

Vee-block work-holders accommodate pins of various sizes WITHOUT ANY CHANGE IN TOOLING

This and other Besly Grinders of basic designs are readily adapted to many specialized jobs. Besly engineers—with 50 years of accumulated experience—are ready to help you select the right grinder to do your work with speed and precision—*at the lowest cost possible.*

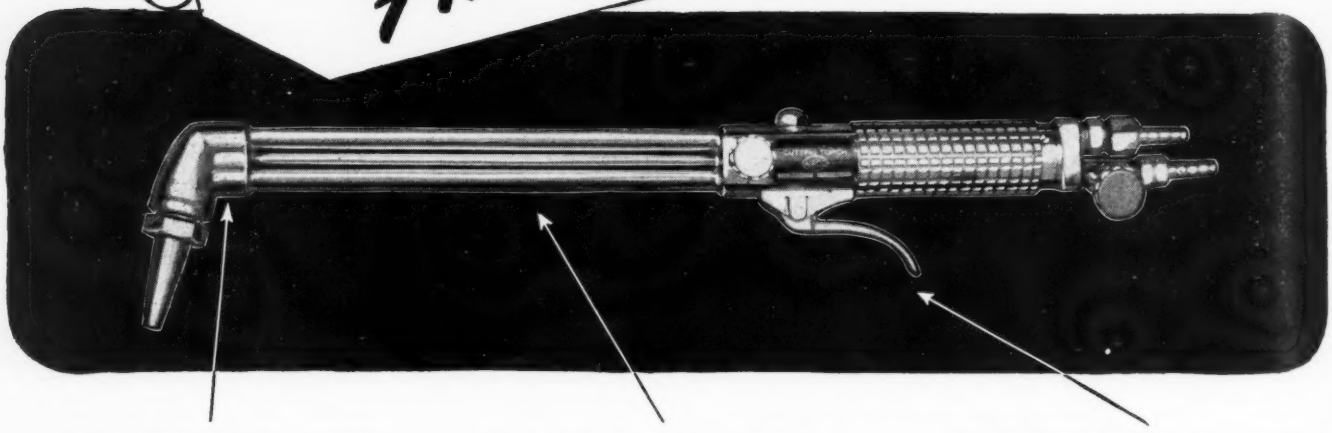
BESLY

BESLY GRINDERS AND ACCESSORIES
BESLY TAPS • BESLY TITAN ABRASIVE WHEELS

CHARLES H. BESLY AND COMPANY • 118-124 N. Clinton St., Chicago 6, Ill. • Factory: Beloit, Wis.

Again Available

. . . The Airco Series 9000 Cutting Torch with Monel Metal Head and Stainless Steel Tubes

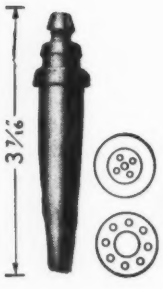


MONEL METAL HEAD for long trouble-free service; furnished with straight, 75°, or 90° angle heads in various torch lengths.

STAINLESS STEEL TUBES have greater rigidity and heat resistance — all connections are silver brazed to assure, permanent, leakproof service.

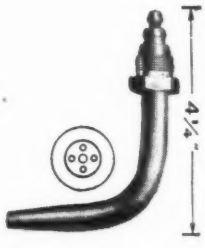
STAINLESS STEEL LEVER in a natural position for effortless operation.

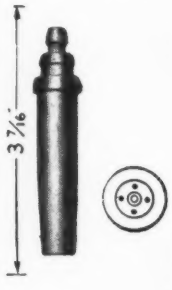
. . . and in addition to these outstanding, long-wearing features, this torch has **GREAT** versatility. It can be used for all conceivable types of cutting operations by means of many interchangeable types of cutting tips — a few of which are shown here:



STYLE 144 — For General Hand and Machine Cutting

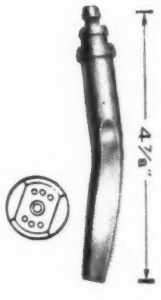
STYLE 181 — For Riser Cutting





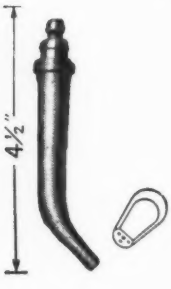
STYLE 197 — For Rivet Washing

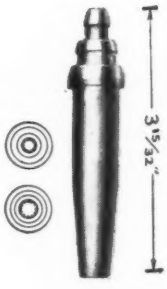
STYLE 183 — Gouging, Removing Imperfect Welds, Grooving and Flame Machining



STYLE 195 — For Hand Cutting of Rivet Heads and Machine Cutting 45° Bevels

STYLE 209 — For General Hand and Machine Cutting with Oxygen and Propane or with Oxygen and Natural Gas





FOR COMPLETE INFORMATION ABOUT THIS VERSATILE TORCH, WITH ITS FULL COMPLEMENT OF TIPS, WRITE FOR BULLETINS ADC-617 AND ADG-1098. Address: Air Reduction, General Offices, 60 East 42nd St., New York 17, N. Y. In Texas: Magnolia Airco Gas Products Company, General Offices, Houston 1, Texas. Represented Internationally by Airco Export Corp.

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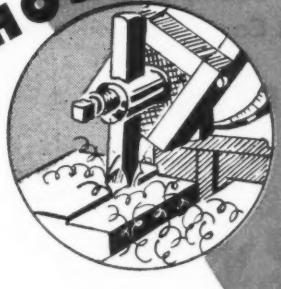
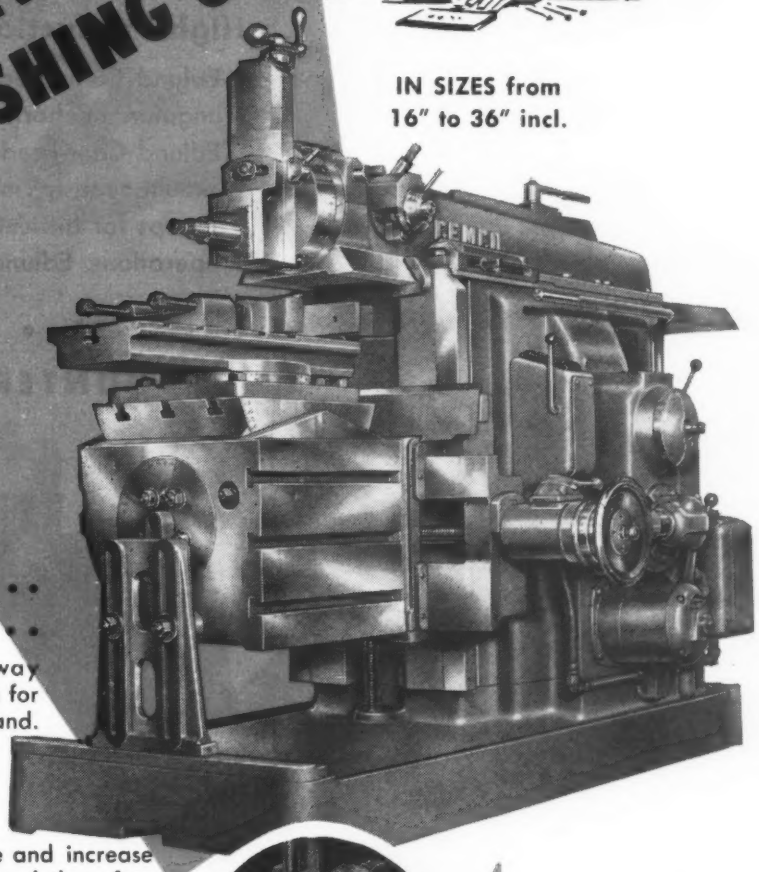
GEMCO
MULTI-PURPOSE SHAPERS

RUGGED AS A RHINO FOR DEEP HOGGING CUTS

PRECISE AS A JEWEL CUTTER FOR THOSE FINISHING CUTS

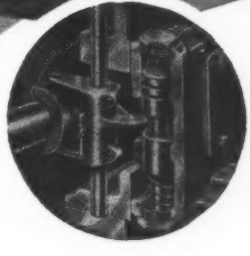


IN SIZES from 16" to 36" incl.



LESS MAN HOURS PER JOB . . . MORE PROFITS PER DAY . . . . .

IN GEMCO Multi-Purpose Shapers you get 2-way production efficiency...an unmatched ruggedness for those deep hogging cuts on the workpiece at hand. Then, with a quick switch of the tool bit and re-setting of the machine, it produces to close tolerances for the precise finishing cuts. This adaptability and efficiency is rarely found in ONE machine! Thus you save on production time and increase profits. Featuring also the exclusive GEMCO Lubrigard, the safety device that prevents injury to the machine should any failure in the lubricating system occur, GEMCO Shapers give you service plus...and the most for your money. Furnished in three models ...Plain, for average shop work; Production, for general machine shop and heavy production work; Universal, for tool and die work. Size of stroke...16" to 36" incl. GEMCOS are the Shapers on which to standardize for a high standard of work.



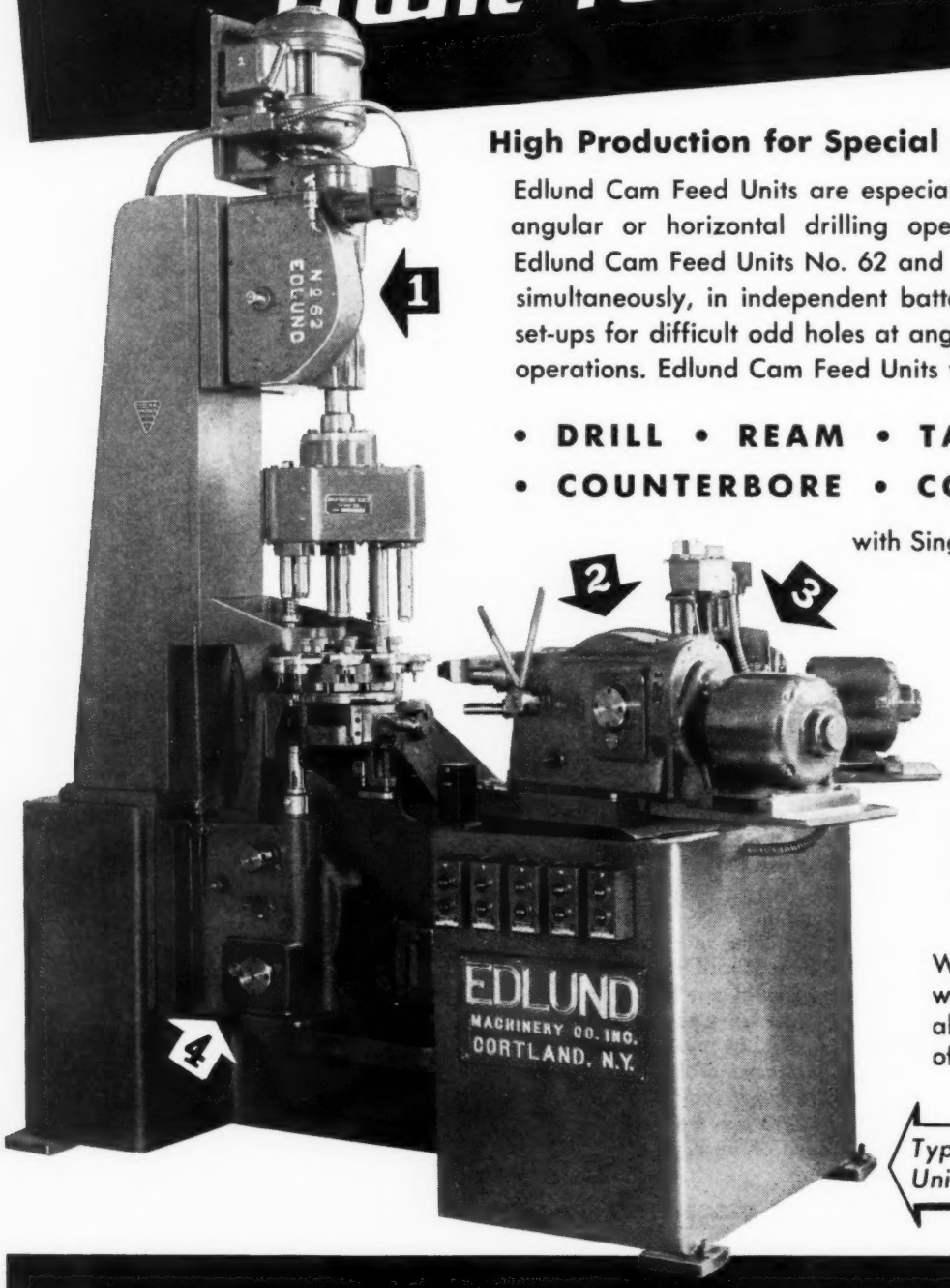
WITH EXCLUSIVE LUBRIGARD SAFETY DEVICE

WRITE TODAY FOR DESCRIPTIVE BULLETIN GC-13-M

MFRS. OF PRECISION MACHINERY SINCE 1917

GENERAL ENGINEERING & MFG. CO.
ST. LOUIS 16, MISSOURI

EDLUND
Cam Feed Units



High Production for Special Drilling Operations

Edlund Cam Feed Units are especially adaptable for vertical, angular or horizontal drilling operations. Combinations of Edlund Cam Feed Units No. 62 and No. 125 can be operated simultaneously, in independent batteries, or singly to simplify set-ups for difficult odd holes at angles to the main machining operations. Edlund Cam Feed Units will

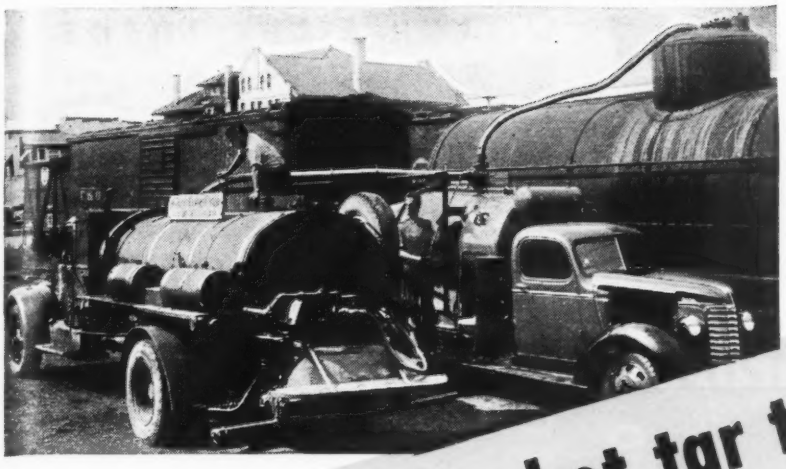
• DRILL • REAM • TAP • SPOT FACE
• COUNTERBORE • COUNTERSINK

with Single Tools or Multiple Heads

Write for this Bulletin which presents full details about various applications of Edlund Cam Feed Units.

Typical EDLUND Cam Feed Unit Set-up with Four Units.

EDLUND MACHINERY CO. INC., CORTLAND 1, N. Y.



American Steel Interlocked Flexible Tar and Asphalt Hose is here being used on tank car unloading equipment made by the Cleaver-Brooks Company of Milwaukee, Wisconsin. This type of hose is ideal for conveying hot tar and asphalt, since it is adapted to rough handling and is unaffected by the heat and chemical action involved in such use.

From pumping hot tar to shielding ignition systems

In the Glenn L. Martin Company's new "2-0-2" transport, American HTCD Shielding Conduit shields the ignition system and prevents interference with radio and radar operation. This conduit consists of an inner core of fully interlocked stainless steel flexible tubing, two layers of tinned copper wire braid and, finally, a molded synthetic cover for protection against moisture, dirt, dust and oil.

Flexible Metal Hose Performs Best

FOR A WIDE RANGE OF USES, such as transferring hot tar and asphalt, or shielding an airplane's ignition system to eliminate interference with radio and radar, there is a flexible product of American Metal Hose—specifically engineered for the job.

Wherever vibration, misalignment or connecting moving parts creates a problem in the conveyance of steam, oil, water and other liquids or gases, a most economical and efficient solution can usually be found in the American line:

American Metal Hose is available in brass, bronze, aluminum, steel, and other metals, some of these in sizes up to 12" I.D.—made from strip in four spirally wound types. *American Seamless Flexible Metal Tubing*, as flexible as garden hose and as leakproof as the seamless bronze tube from which it is made, is standard in sizes ⅛" to 4" I.D. Either hose or tubing can be furnished complete with fittings to your exact specifications.

Descriptive literature will be mailed on request, and our Technical Department will be glad to help on exceptional problems. 47204

ANACONDA
from mine to consumer

American
METAL HOSE

THE AMERICAN BRASS COMPANY
American Metal Hose Branch
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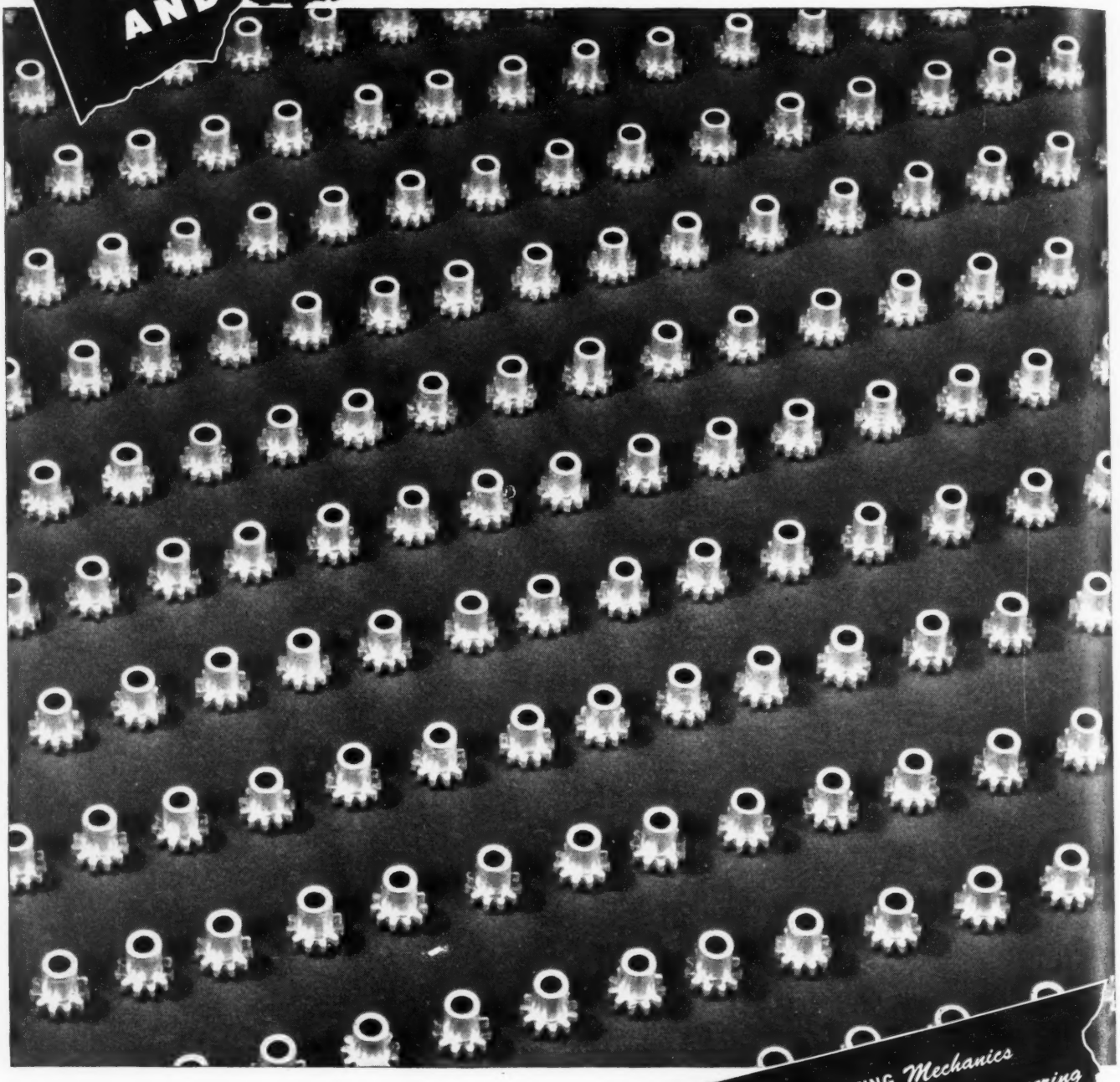
Subsidiary of Anaconda Copper Mining Company
In Canada: THE CANADIAN FAIRBANKS-MORSE CO., LTD., *Montreal 3, Canada*

MADISON-KIPP DIE CAST GEARS AND PINIONS . .

. . . FOR LIGHT LOADS

The daily production potential of some gear designs is extremely high when made by the Kipp die casting process. Size, usage factors, and quantities required are important, but the most vital consideration is the design which must be of a type that will eject from a steel die.

You can depend on the recommendations you get from qualified engineers in the Die Casting Industry. They consider not only your interests but the long-time welfare of the industry.



- Skilled in DIE CASTING Mechanics
- Experienced in LUBRICATION Engineering
- Originators of Really High Speed AIR TOOLS

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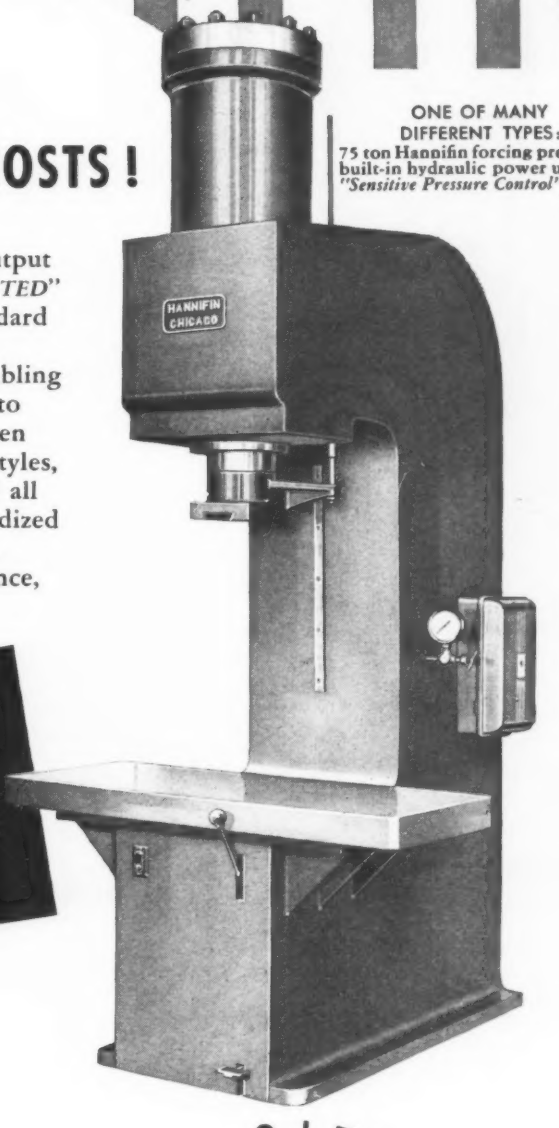
HANNIFIN *Engineered*—

to help you CUT PRODUCTION COSTS!



ONE OF MANY DIFFERENT TYPES:
75 ton Hannifin forcing press with built-in hydraulic power unit and *"Sensitive Pressure Control"*.

Cut production costs and boost plant output —you can do it with Hannifin "*JOB-TESTED*" Hydraulic Presses! Hannifin offers standard and special types of presses for every purpose: straightening...press-fit assembling ...forming...molding—in capacities up to 150 tons. Built in a wide variety of open gap and two, three, and four column styles, complete with motor-driven pump and all necessary gauges and controls. Standardized designs for earlier delivery, lower cost. Quality construction for low maintenance, long life. Ask for a copy of Bulletin No. 60-G.

HYDRAULIC *job-tested* PRESSES

SUPERIOR DESIGN. Frames welded from steel plate and normalized before machining provide high strength and rigidity without excessive weight. Your choice of standard or special tables.

PRECISION-BUILT PRESSURE CYLINDERS. Cylinders *TRU-BORED* and honed to satin finish by exclusive Hannifin honing process. Tight-sealing precision piston rings insure maximum power with minimum need for maintenance.

ADVANCED CONTROL FEATURES. Everything you want for better, more accurate, more convenient operating control! Hannifin's *exclusive* Sensitive Pressure Type or arranged to meet the requirements of the operation.

ENGINEERING RECOMMENDATIONS. See your local Hannifin representative or write for complete information and recommendations.

- A single lever (hand or foot operated) gives operator complete control of ram movement and pressure —thanks to Hannifin's *exclusive* "Sensitive Pressure Control"! Move the lever down slightly and the ram approaches work at "no pressure"... increase lever pressure, and ram pressure increases...release lever, and ram returns automatically to starting position.

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Nationwide Sales and Service

HANNIFIN CORPORATION

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AIR CYLINDERS • HYDRAULIC CYLINDERS • HYDRAULIC PRESSES
PNEUMATIC PRESSES • HYDRAULIC RIVETERS • AIR CONTROL VALVES

● *Built by* THE McGONEGAL MFG. CO.

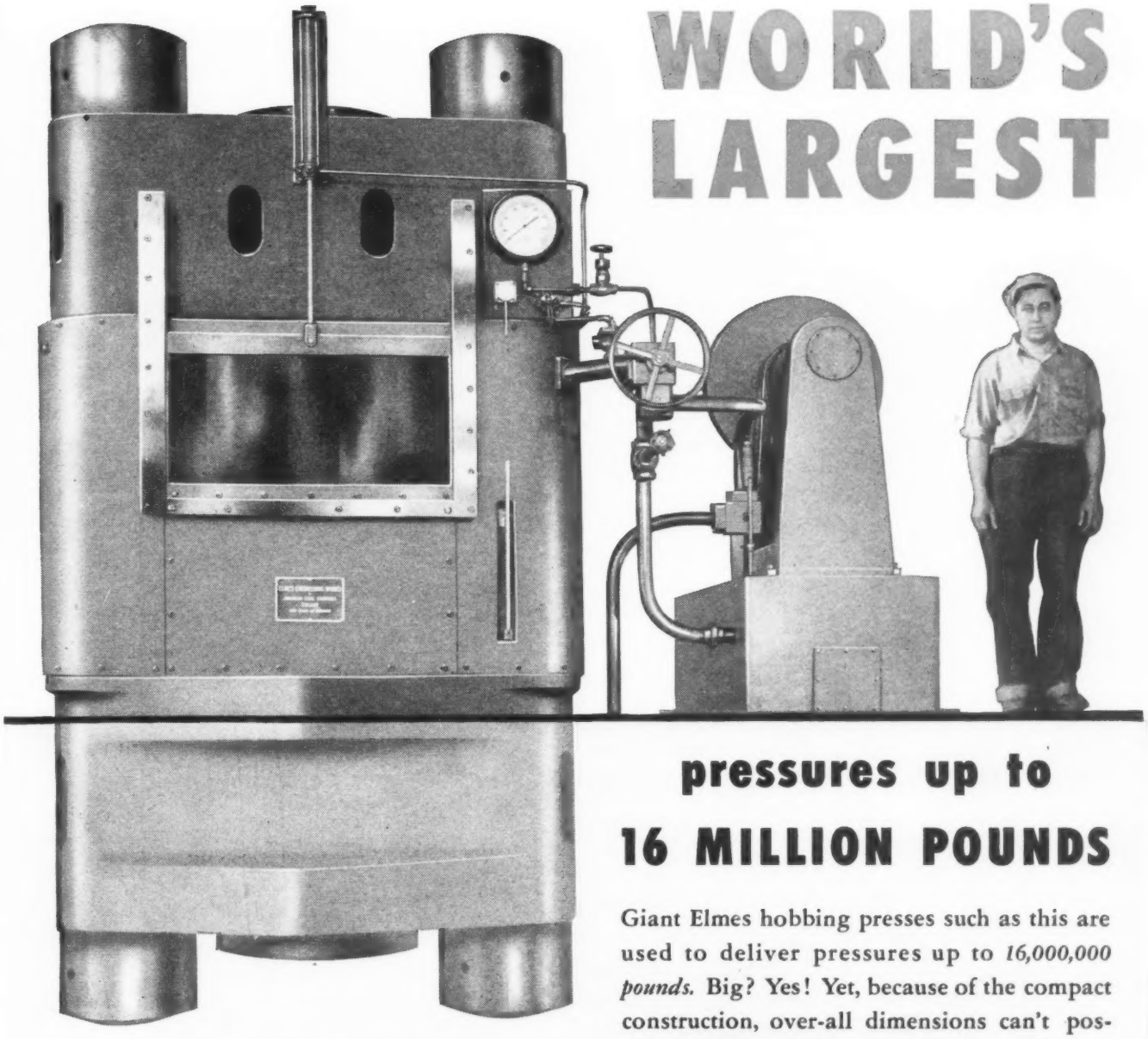
SKF
Puts the RIGHT BEARING in the RIGHT PLACE

ACCURATE BEARINGS FOR GRINDING ACCURACY

The performance of a grinder depends upon its spindle, and the spindle itself is only as good as its bearings. Because this Themac Precision Grinder is SKF-equipped, its ability to grind surfaces accurately and to obtain a good finish is a certainty. Long-lived SKF Bearings maintain their precision and run smoothly under varying feeds at high speeds—outstanding factors in the fast, precise removal of metal. Making a wider variety of bearing types and sizes than any other manufacturer, SKF is well qualified to put the right bearing in the right place. 6252

SKF INDUSTRIES, INC., PHILADELPHIA 32, PA.

WORLD'S LARGEST



pressures up to 16 MILLION POUNDS

Giant Elmes hobbing presses such as this are used to deliver pressures up to *16,000,000 pounds.* Big? Yes! Yet, because of the compact construction, over-all dimensions can't possibly indicate the *tremendous* force of these presses.

Sinking hardened hobs into prepared blanks of cold steel calls for (1) irresistible pressure, (2) utmost rigidity, (3) instant response to sensitive control, and (4) *implicit* operator confidence. Elmes hobbing presses are famous for accurate work.

All sizes, from 175 tons upward, combine many features of design and construction which make these presses *precision tools* in skillful hands. Recommendations and helpful suggestions are yours for the asking.

ELMES

Since 1851

HYDRAULIC EQUIPMENT

NEW BULLETIN 1030B describes both the hobbing process and modern Elmes hobbing presses for economical production of duplicate die inserts, multi-cavity molds, and intricate single cavities. Ask for your copy.

ELMES ENGINEERING WORKS *of* AMERICAN STEEL FOUNDRIES, 222 N. Morgan St., Chicago 7, Ill.

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METAL-WORKING PRESSES · PLASTIC-MOLDING PRESSES · EXTRUSION PRESSES · PUMPS · ACCUMULATORS · VALVES · ACCESSORIES

TO INSURE ACCURACY, USE—

SOUTH BEND *Precision* LATHES

South Bend Lathes help to increase plant efficiency and profits by raising precision standards both in the toolroom and in the production shop.

These lathes are designed and built to work to close tolerances and produce a smooth finish, for ease and speed of operation, and to give long, dependable service. Versatile, too, they are capable of performing a wide variety of operations on all types of machinable materials with a minimum of change-over and set-up time. Attachments are available which help to simplify and speed tooling for special classes of work, and in many instances eliminate the need for special fixtures.

South Bend Engine Lathes and Toolroom Lathes are made with 9″, 10″, 13″, 14½″, and 16″ swings, bed lengths to 12′, and collet capacities to 1″. Precision Turret Lathes are made with collet capacities to ½″ and 1″. Write today for Catalog 100-D which illustrates and describes the complete line of lathes and accessories.

COLLETS

Equip Your Lathes with Complete Sets

A complete set of collets is especially helpful for toolroom and maintenance work. Often the time saved in getting out a single rush job without having to wait for a specially ordered collet will more than compensate for the cost of a full set of collets.

South Bend Collets are made in four types, and are available in either steel or brass. Each collet is carefully inspected and tested before it is packed for shipment.

SOUTH BEND LATHE WORKS

424 EAST MADISON STREET • • • SOUTH BEND 22, INDIANA

• LATHE BUILDERS SINCE 1906

SAVE TIME

STEP UP PRODUCTION!

"KNOCK-OUT" CHUCKS ARE FAST • POSITIVE • NON-SLIP

A twist of the wrist tightens or loosens this self-energizing chuck. The heavier the work-load the tighter its 3 hardened jaws grip the tool with a radial pressure that prevents twist or slip. Its fast, positive action saves time—saves tools—steps up production.

"KNOCK-OUT" EXPANDING MANDRELS STEP UP PRODUCTION ON TURNING, MILLING AND GRINDING OPERATIONS

SIMPLE—FAST—ACCURATE. "Knock-Out" Expanding Mandrels hold work from 3/8" to 5 1/2" hole. Perfect support without distortion for thin wall sleeves—sure, positive grip on heavy pieces. Ideal for production or tool-room.

See your Dealer or mail the coupon TODAY for illustrated bulletins.

K.O.LEE COMPANY

MANUFACTURERS OF MACHINE TOOLS AND AUTOMOTIVE MAINTENANCE EQUIPMENT

ABERDEEN, SOUTH DAKOTA

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K. O. LEE COMPANY
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Please send me illustrated bulletins on
☐ **"Knock-Out" Keyless Chucks.**
☐ **"Knock-Out" Expanding Mandrels.**

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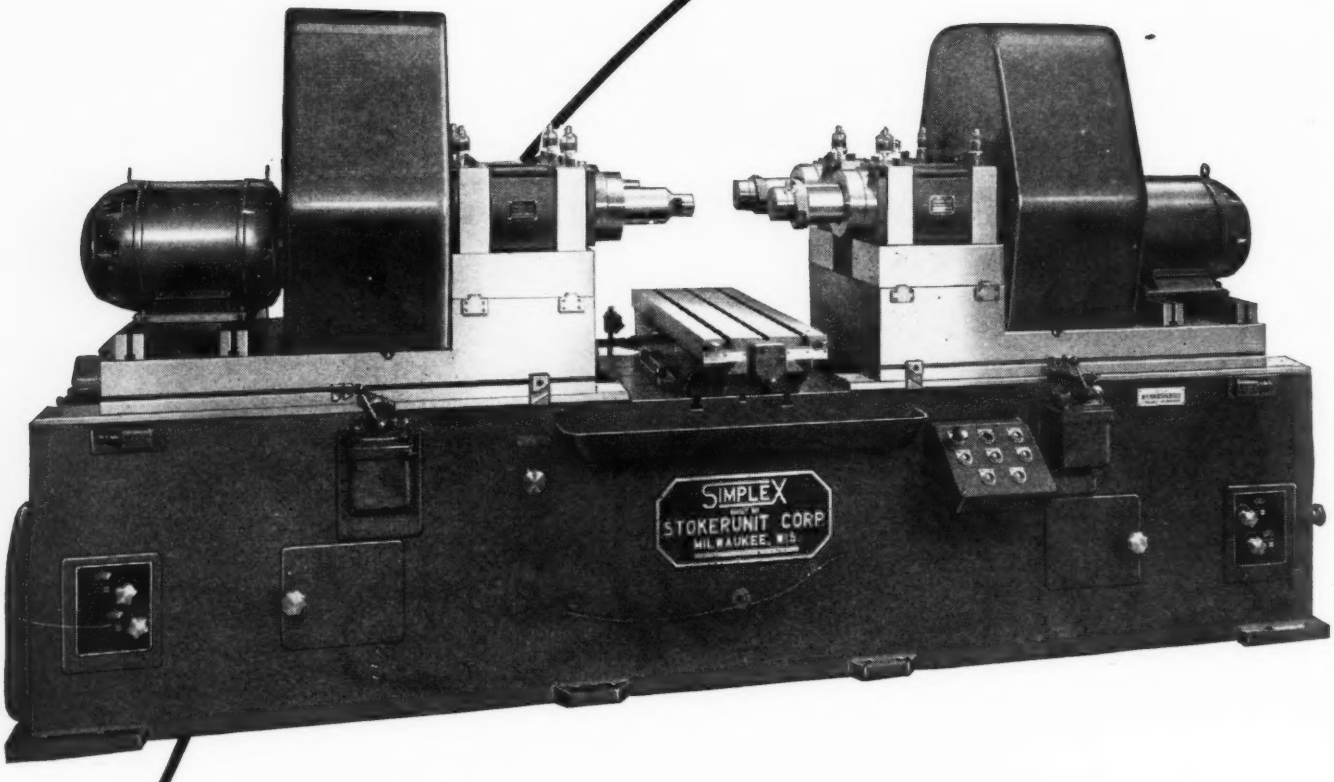
Address_____

City_____ State_____

SIMPLEX

Increasing wage rates of today make necessary new methods of reducing costs. At medium production rates, this becomes difficult with general purpose machine tools. Simple multiple tooling and fixtures, indexing from roughing to finishing position, offer a new cost reduction method. Tooling costs are low — job possibilities endless.



This photograph shows a SIMPLEX 4U 2-way Precision Boring Machine equipped with four #4 spindles and a hydraulically indexed sliding table operating between adjustable positive stops. On the sliding base a single work holding fixture is mounted providing for operating on the work from both ends. After the roughing operation is completed on both ends, the table is indexed to the finishing position, the finishing operations are performed on both ends simultaneously and the completed job is ready to remove from the fixture to change to the next job. The fixture and tools are removed and retained intact, ready for a quick set-up when the job is again run. The automatic cycle relieves the operator and helps maintain predetermined production schedules.

Precision Boring Machines

STOKERUNIT CORPORATION

SIMPLEX Machine Tools Division

4526 West Mitchell Street, Milwaukee 14, Wisconsin

Precision Boring Machines, Planer Type Milling Machines and Special Machine Tools

Here's how to buy

INDUSTRIAL FURNACES AND OVENS

SUPPOSE YOU HAD THE TIME TO INSPECT 10,000 INDUSTRIAL FURNACES AND OVENS —CHECK 4,000 SPECIFICATIONS . . .

Somewhere in this huge inventory there is a good probability that WAA has the furnace or oven to fit your requirements. But screening the inventory to find the specific equipment you need is a big job—so let WAA do the screening for you. WAA will then submit for your consideration that equipment in the inventory which appears to be of greatest interest to you, based on the data you submit.

The booklet shown contains pictures of many types of available furnaces and ovens. Send for this booklet and fill out the specification blank enclosed.

If you have not received your copy of this valuable new WAA booklet, clip and mail the attached coupon—NOW!

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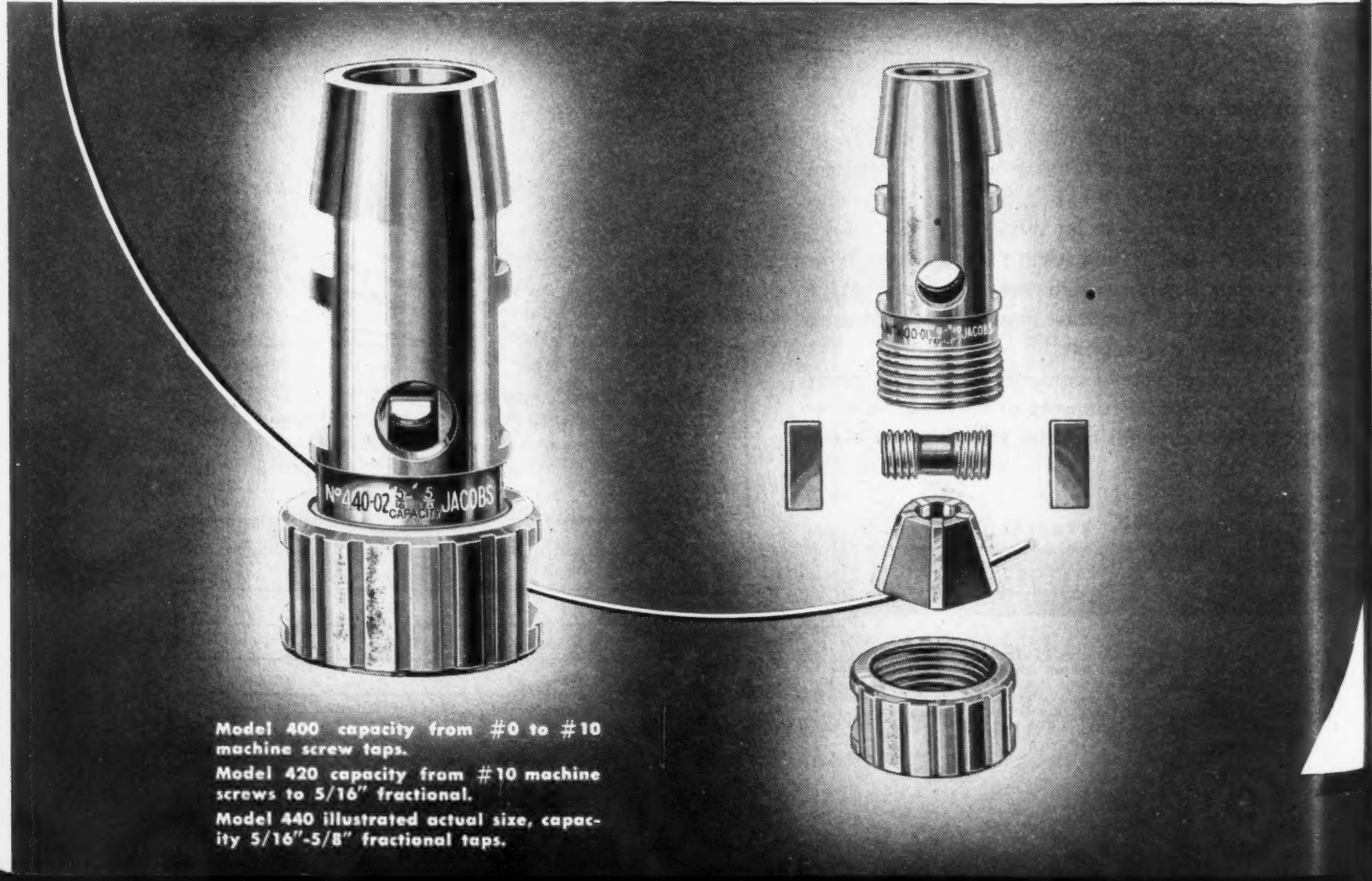
1092

Here it is...

RUGGED, light and compact—featuring positive drive and accuracy—this new type Tap Chuck is ideal for use on all types of tapping heads and tapping machines. Lightness and compactness mean less torsional inertia on the spindle which contributes greatly towards reducing tap breakage—particularly in bottom tapping—and allows for quicker stopping and reversing of the tapping spindle. The heart of this chuck is the Jacobs Rubber-Flex Collet. Made as a single unit, the Rubber-Flex Collet is comprised of several hardened steel jaws permanently bonded into a synthetic rubber body. All working surfaces of this collet are precision ground after moulding and the collet is centralized by a ground conical bore in the chuck body, assuring extreme concentricity. Because the jaws of the Rubber-Flex Collet are rigid steel pieces ground to a fixed shape and all flexing is assumed by the resilient synthetic rubber web separating the jaws, parallelism of the jaw bites is assured throughout the entire range of the collet so that the smallest tap is held as firmly and as accurately as the largest.



Model 400 capacity from #0 to #10 machine screw taps.

Model 420 capacity from #10 machine screws to 5/16" fractional.

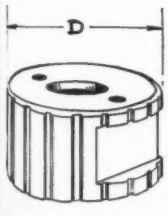
Model 440 illustrated actual size, capacity 5/16"-5/8" fractional taps.

BRAND NEW!

A STRONG, LIGHTWEIGHT TAP CHUCK

MADE WITH THE JACOBS RUBBER-FLEX COLLET

CHECK THESE SPECIAL FEATURES!

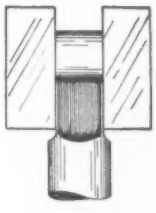


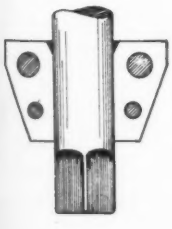
SMALL DIAMETER

Combined with light weight keep to a minimum the torsional inertia which a holder builds up on a tapping spindle.

POSITIVE DRIVE

Floating back jaws provide positive drive on all sizes of tap squares.



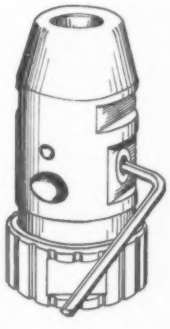


GREATER GRIPPING POWER

The parallel bite of the Rubber-Flex Collet prevents disengagement of the positive drive.

SIMPLIFIED TAP CHANGING

Quarter turn of cap and the jaw screw disengages tap from chuck. Large sight hole facilitates tap changing.

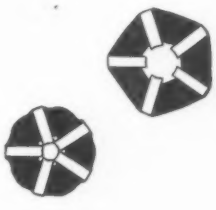


GREATER ACCURACY

Completely ground collet and chuck body give unusual control of run-out.

WIDE COLLET RANGE

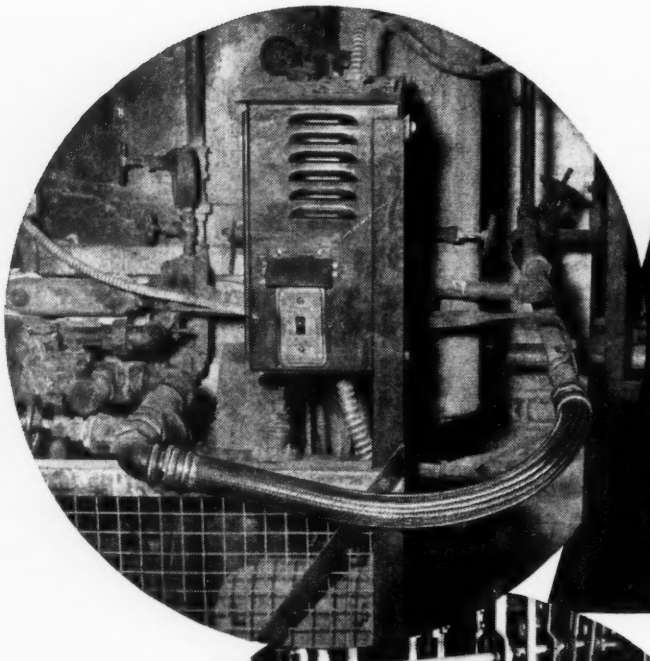
One collet takes all taps in its range. No individual sleeves or changing required.



For prices and complete specifications of this new chuck ask your Industrial Supply Distributor for Jacobs catalogue 47-T.

Jacobs Chucks

THE JACOBS MANUFACTURING COMPANY
HARTFORD 2, CONNECTICUT



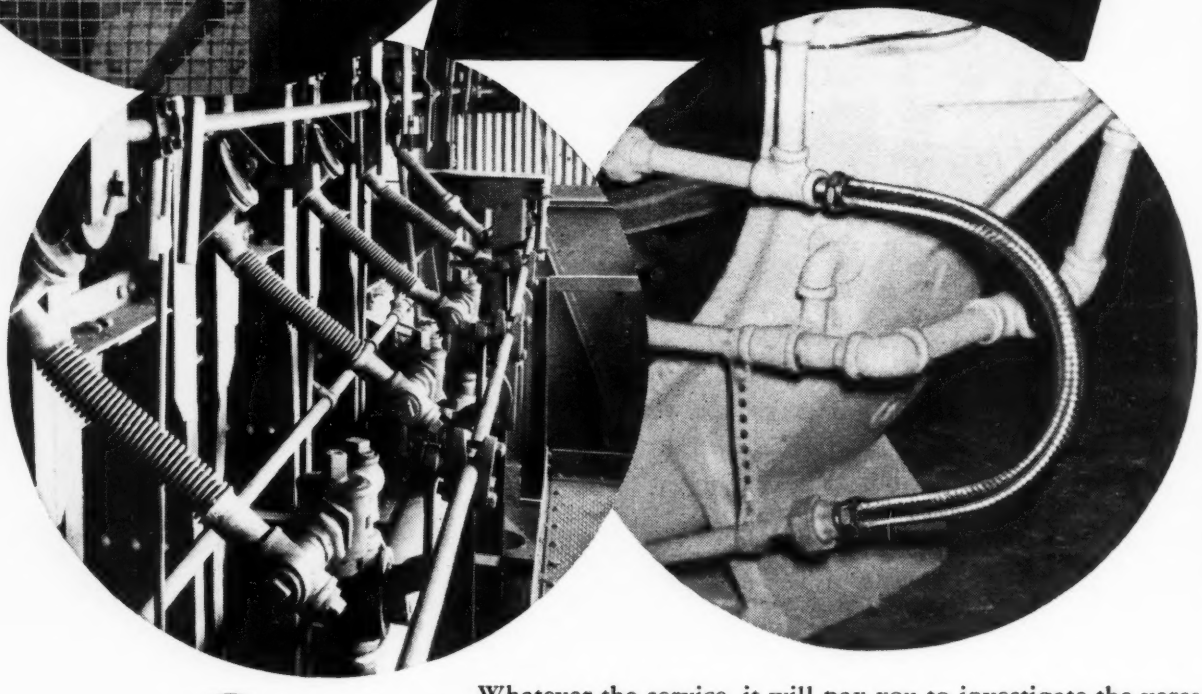
FLEXONICS* at work

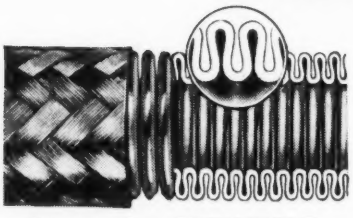
WHAT'S YOUR PROBLEM

Flexation?

Expansion or Contraction?

Misalignment?





Cutaway view of REX-WELD Flexible Metal Hose Type RW-81.

***the science of FLEXONICS . . .**

"The controlled bending of thin metals for use under varying conditions of temperature, pressure, vibration and corrosion" . . . is exemplified in the basic products of Chicago Metal Hose Corporation.

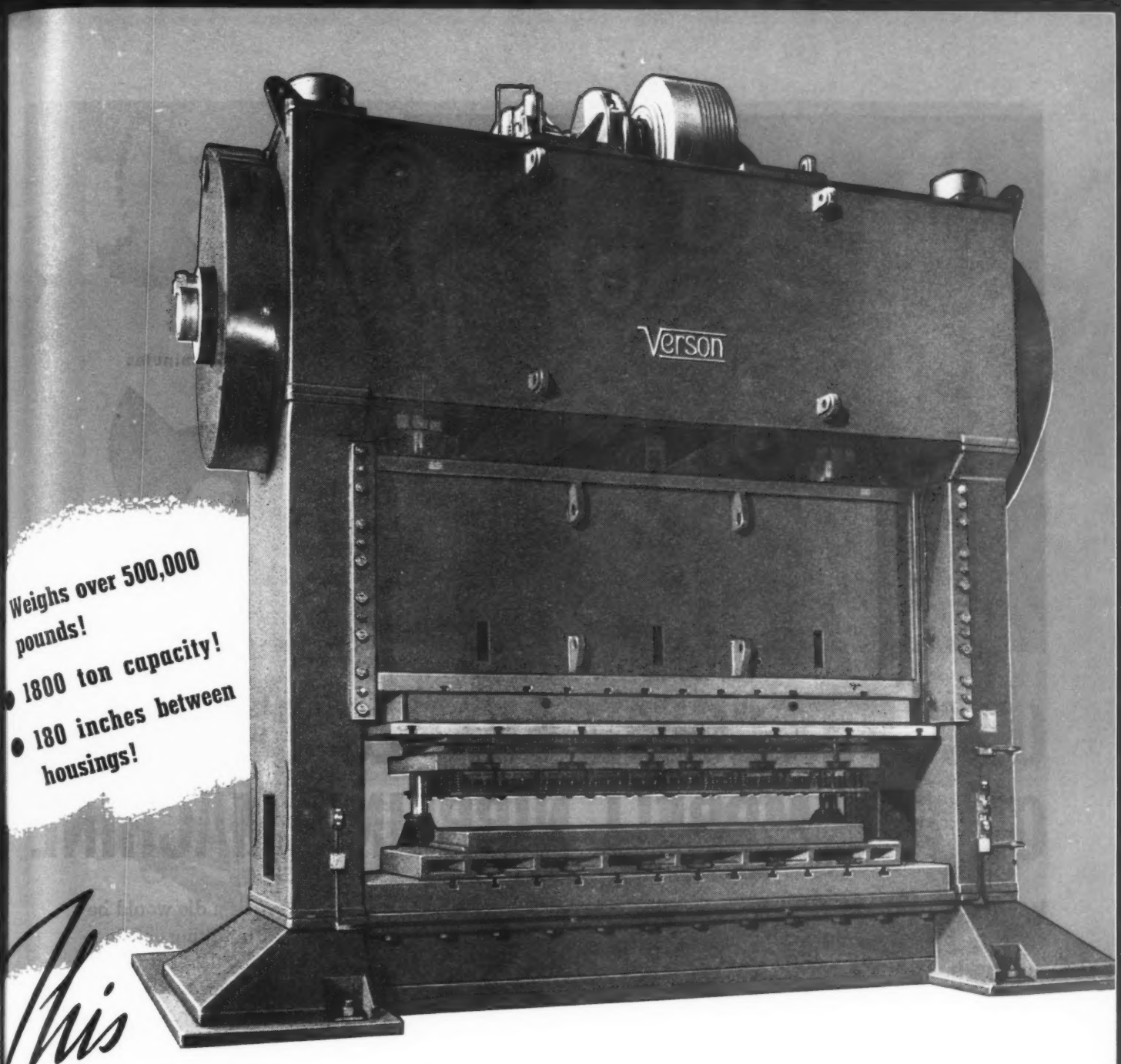
Whatever the service, it will pay you to investigate the versatility of *REX-WELD Flexible Metal Hose.* For this is the utility connection for most industrial uses. It offers a wide range of applications among which are included, in addition to these illustrated above; the handling of low to high-pressure steam; hot and cold gases, heavy and searching oils.

REX-WELD is highly serviceable under prolonged flexations, compensates for expansion or contraction, and may be readily installed to care for misalignment. It is made in one-piece continuous lengths up to 50 feet in *steel* or *bronze* and in size ranges from 3/16" to 4" I.D., inclusive. Send for data sheet.

"FLEXON" *identifies C. M. H. products, which have served industry for more than 44 years.*

CMH CHICAGO METAL HOSE CORPORATION

Maywood, Illinois • Plants: Maywood and Elgin, Illinois



Weighs over 500,000 pounds!

- 1800 ton capacity!
- 180 inches between housings!

This

Verson PRESS

helps get the goods to market!

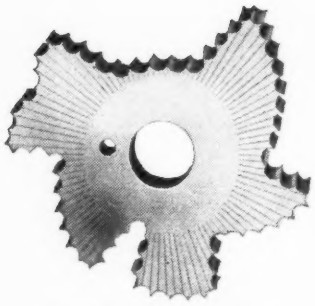
On everything from trucks to box cars, Verson Presses like the one shown above are helping fill the gap between demand and productive capacity. Backed by over 25 years of press building experience, Verson Presses are rugged tools, designed and built throughout to boost production and cut unit costs. They offer such features as the stiffer, stronger Verson Allsteel Welded Frame, full eccentric action and a host of other engineering developments and refinements. And now, for an ever-growing list of products, completely automatic press operation is possible, providing even greater savings in time and money.

If you make anything of metal and are troubled by low production rates and high costs we'd like to talk to you.

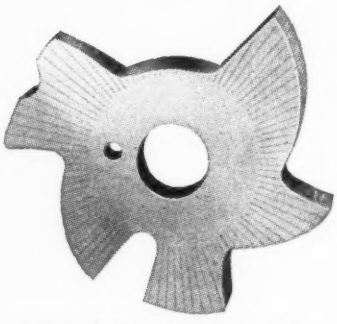
VERSON ALLSTEEL PRESS COMPANY
9309 So. Kenwood Ave. Chicago 19, Illinois

Originators and Pioneer Builders of Allsteel Welded Presses

OWER PRESSES ★ CLUTCHES ★ FORGING PRESSES ★ DIE CUSHIONS ★ HYDRAULIC PRESSES ★ PRESS BRAKES



Drilled • 50 minutes



Nibbled • 4 minutes or less

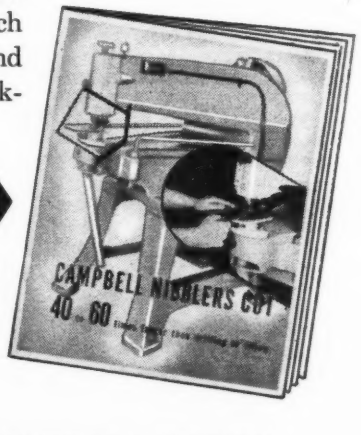
ODD, IRREGULAR SHAPES CUT FAST ON A CAMPBELL NIBBLING MACHINE

With a Campbell Nibbler you can cut—cleanly, quickly and cheaply—all kinds of shapes from sheet metal or composition. There is no distortion of material—no internal strain—no hidden fractures—no burr.

BRIDGEPORT, CONNECTICUT—The first use of this machine was for experimental and development work. But its use has gone far beyond that. In many plants, nibbling has become a standard method of cutting—the CAMPBELL NIBBLER a real production machine.

Its best use is where odd, irregularly shaped parts must be cut in quantities up to several hundreds and where the cost of a die would be prohibitive. As compared with drilling or filing, nibbling is from 40 to 60 times faster.

The CAMPBELL line of Nibbling Machines includes 7 models, the largest of which is shown here. They are described fully in a booklet which we will be glad to send you. Just ask for Booklet DH-593.



Send for this Booklet DH-593

ALSO MAKERS OF A COMPLETE LINE OF ABRASIVE CUTTING MACHINES

ACCO

TRADE MARK

ANDREW C. CAMPBELL DIVISION
AMERICAN CHAIN & CABLE • BRIDGEPORT, CONN.

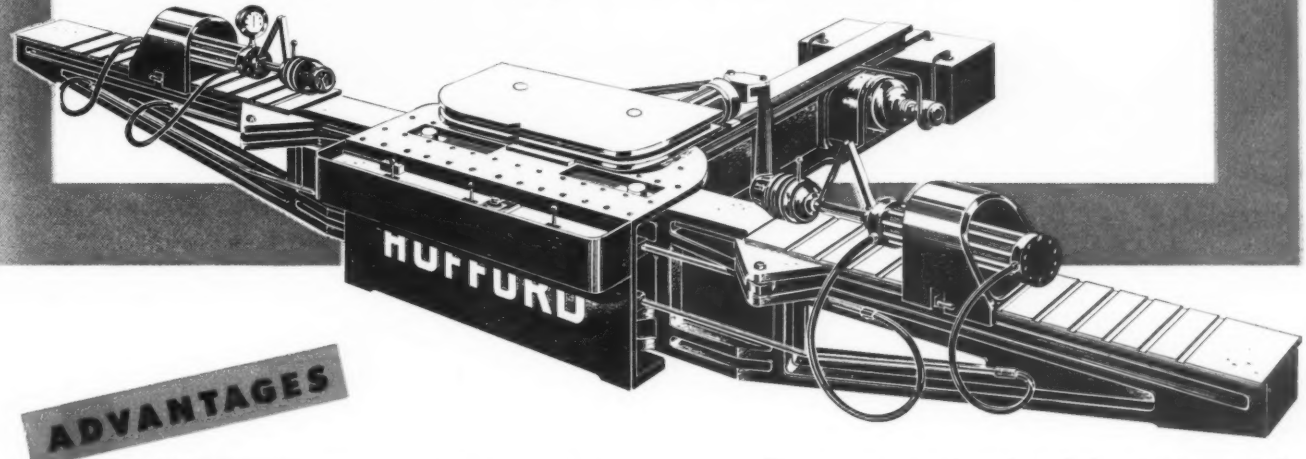
Now, Stretch-form LARGE SHEET STOCK
as well as Extrusions, Rolled Stock, etc.

HUFFORD
HYDRAULIC STRETCH FORMING MACHINES

The basic principle employed by the Hufford Hydraulic Stretch Forming Machine is not limited to handling narrow sheet, extrusions and rolled stock alone. New developments in Hufford design now enable the stretch forming of sheet stock in large sizes . . . a development which opens up a vast number of applications for this faster, more uniform method of mechanically producing accurately shaped structural members and skin surfaces.

What is Hufford Stretch Forming?

Hufford Stretch Forming Machines employ a patented method of producing exact contours from a wide variety of stock. The material to be formed is stretched under hydraulic tension and wrapped around a fixed-position die or form block while under tension.



ADVANTAGES

HIGHER OUTPUT—Conservatively estimated at 300% greater with 30% less man power.

NO WRINKLING—Tension on the workpiece during forming operations overcomes tendency to wrinkle, even when legs of extruded shapes are placed in compression.

NEGLIGIBLE SPRINGBACK—When formed under tension a permanent "set" in the metal is produced, enabling the work to hold its desired shape. If slight springback occurs on contours of maximum curvature, dies can be easily compensated for.

CLOSE DIMENSIONAL TOLERANCES are easily held and parts can be duplicated at any time by recording correct stretching and bending pressures on the die.

LOW COST TOOLING—Dies can be cheaply produced working directly from engineering drawings. Savings in tooling alone often pay for the machine.

These represent only a few of the advantages of the Hufford method of stretch forming. In addition, you obtain better and more uniform physical characteristics of the metal with complete absence of localized strains. Expensive hand labor required by former methods, such as "degreeing," is totally eliminated or markedly reduced.

For speed, for manufacturing economy, for greatest uniformity, investigate the possibilities of Hufford Hydraulic Stretch Forming Machines. Now made in Models A5 and A10 for extrusions and rolled stock-in the new Model 50 for large sheets.

CIRCULARS OR ENGINEERING DATA MAILED FREE ON REQUEST

Hufford MACHINE WORKS, INC.
207 NORTH BROADWAY
REDONDO BEACH, CALIFORNIA

Manufacturers of HYDRAULIC STRETCH-FORMING EQUIPMENT · PORTABLE HYDRAULIC ELEVATORS · STRETCH LEVELING TABLES · HYDRAULIC TILE PRESSES · CUSTOM MACHINE TOOLS · SPECIAL HYDRAULIC APPLICATIONS

George Westinghouse

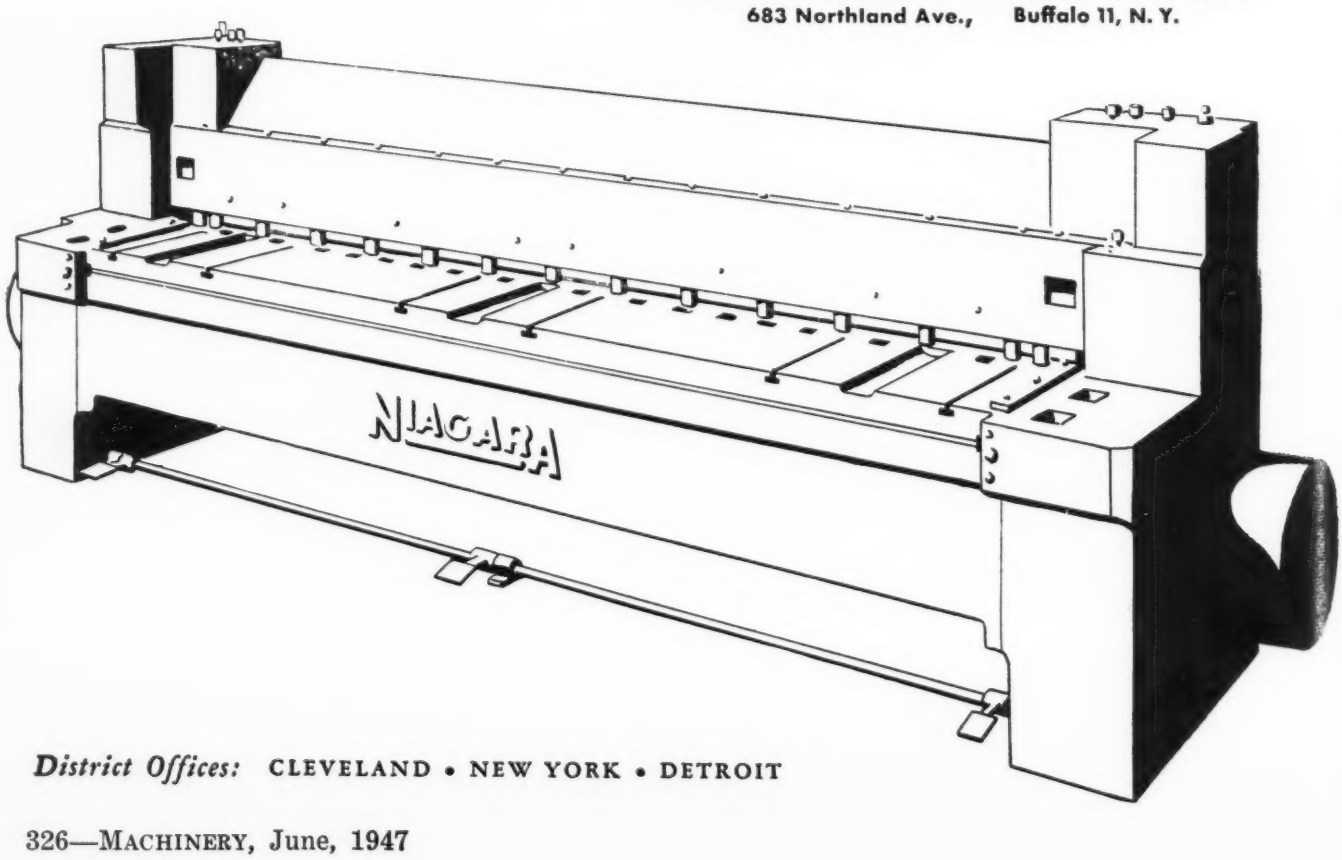
Great Names in America's Progress

● The name George Westinghouse is an honored name not only in industry but in many industries. First prominent through the invention of the air brake, the name and genius of Westinghouse is associated with hundreds of other products known for utility, performance and service to people everywhere. Niagara presses, shears and other machines for working sheet metal are important in the production of an infinite number of products bearing the Westinghouse name. Men responsible for production economy are invited to look into the advanced design of Niagara machines.

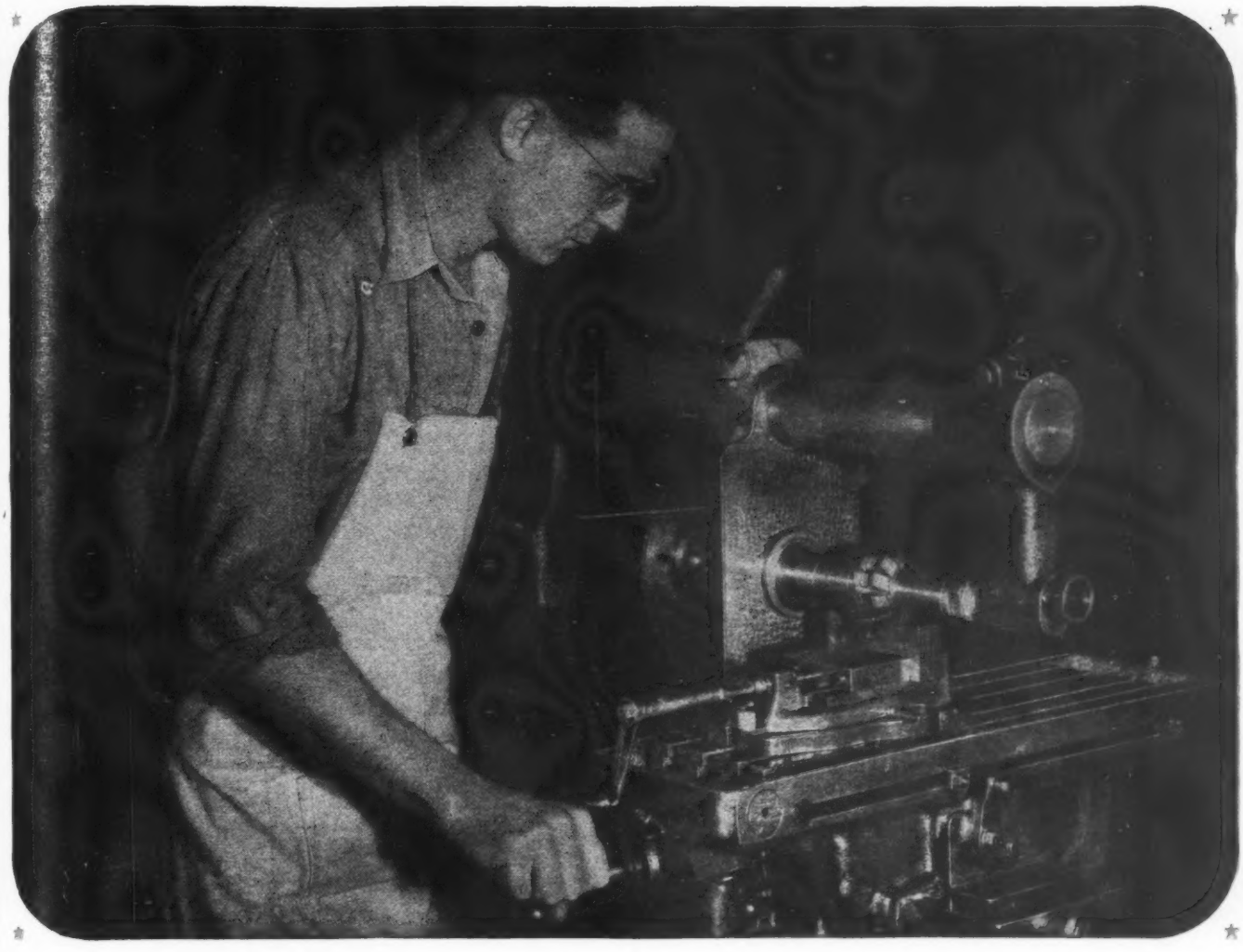
NIAGARA

MACHINE AND TOOL WORKS

683 Northland Ave., Buffalo 11, N. Y.



District Offices: **CLEVELAND • NEW YORK • DETROIT**



IT'S NOT ONLY *Which* CUTTING MATERIAL

BUT HOW YOU USE IT THAT COUNTS

Send for

THIS LATEST HANDBOOK ON

A-L TOOL STEELS

Complete shop data on the properties, uses, forms, sizes and methods of handling every member of the extensive Allegheny Ludlum family of Tool Steels—170 pages, handily pocket-sized and indexed for easy reference. Write for it today—on your company letterhead, please.

ADDRESS DEPT. . . . M-54

THERE'S hardly a single cutting operation that can't, in some way, be improved. Our record files contain hundreds of instances. Redesign of the tool itself often works wonders. In other cases, a switch of cutting materials shows a marked increase in production, or in pieces between grinds.

That's the job of our Mill Service organization—to work with you for improvement—and the Allegheny Ludlum line now offers you absolutely complete selection. The range extends from Carmet carbide metal blanks and tipped tools—through ALX cast alloy-metal ground bits—to DBL and Super DBL low-tungsten high speed steels, as well as the various high-tungsten and "moly" types of high speed steels. Call us in, any time, anywhere.

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ALLEGHENY LUDLUM

STEEL CORPORATION

General Offices

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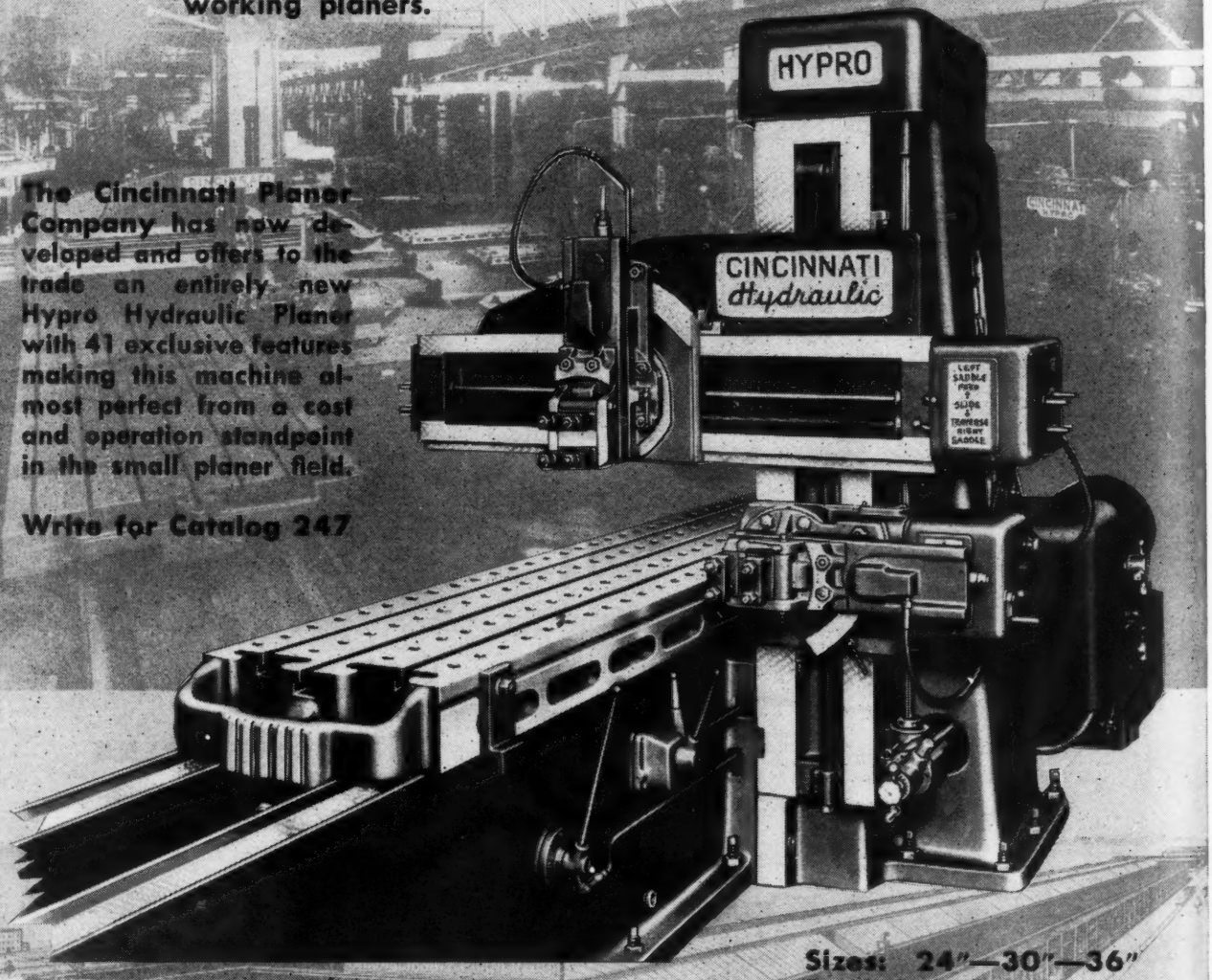
W&D 371

A New Hypro Planer

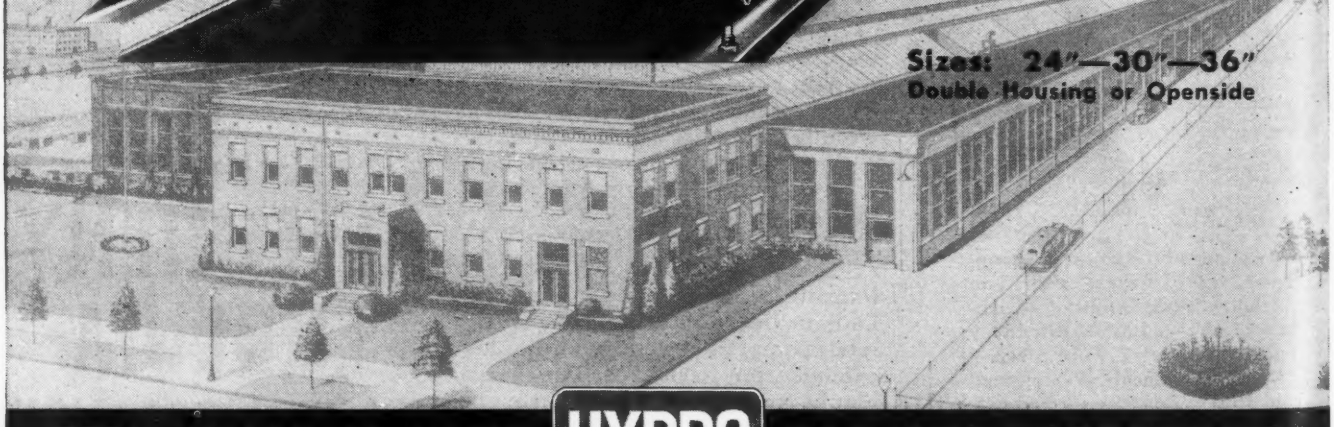
Look at its Background... 50 years of continuous proven leadership in the design and manufacture of metal working planers.



The Cincinnati Planer Company has now developed and offers to the trade an entirely new Hypro Hydraulic Planer with 41 exclusive features making this machine almost perfect from a cost and operation standpoint in the small planer field.

Write for Catalog 247

Sizes: 24"—30"—36"
Double Housing or Openside



THE CINCINNATI HYPRO PLANER COMPANY
PLANERS · BORING MILLS · PLANER TYPE MILLERS
CINCINNATI, OHIO

CLECO PNEUMATIC TOOLS

to be manufactured by

THE REED ROLLER BIT COMPANY

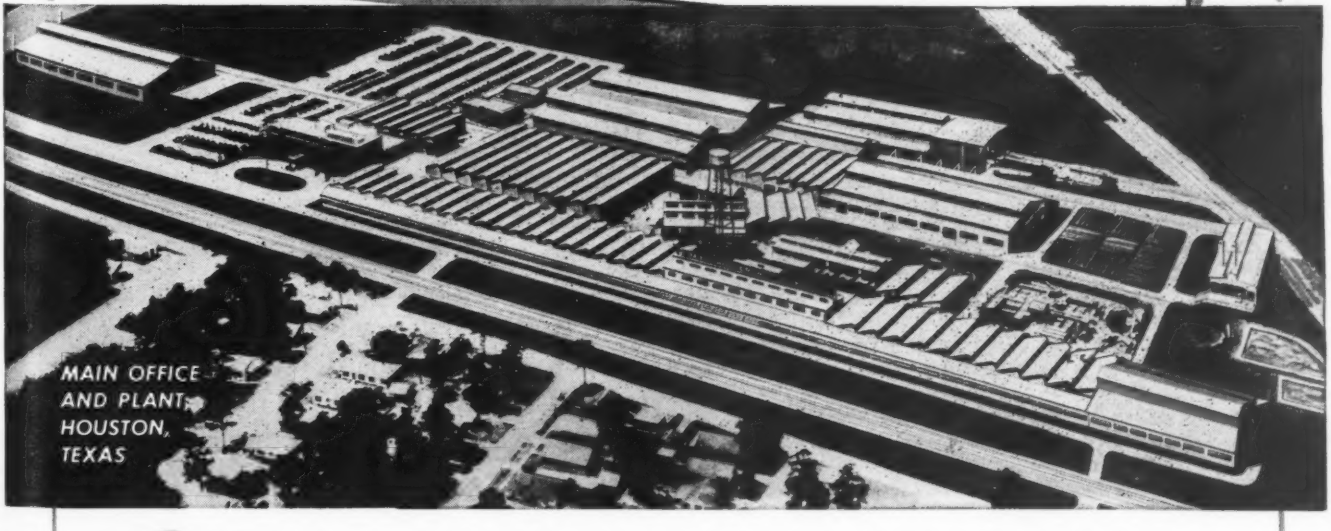
of HOUSTON, TEXAS

THE REED ROLLER BIT COMPANY, of Houston, Texas, announces the purchase from the Cleveland Pneumatic Tool Company, of inventory and manufacturing rights of CLECO PNEUMATIC TOOLS.

Production of these tools will be continued in Houston, Texas.

Organized in 1919, the Reed Roller Bit Company is one of the largest manufacturers of Rotary Drilling Tools in the world. This quarter of a century of experience in the manufacture of tools for the exacting oil industry is your assurance that CLECO PNEUMATIC TOOLS will continue to be the leaders in the field.

You can be assured of the traditional Reed Service . . . prompt, dependable, efficient. Send us your inquiries.

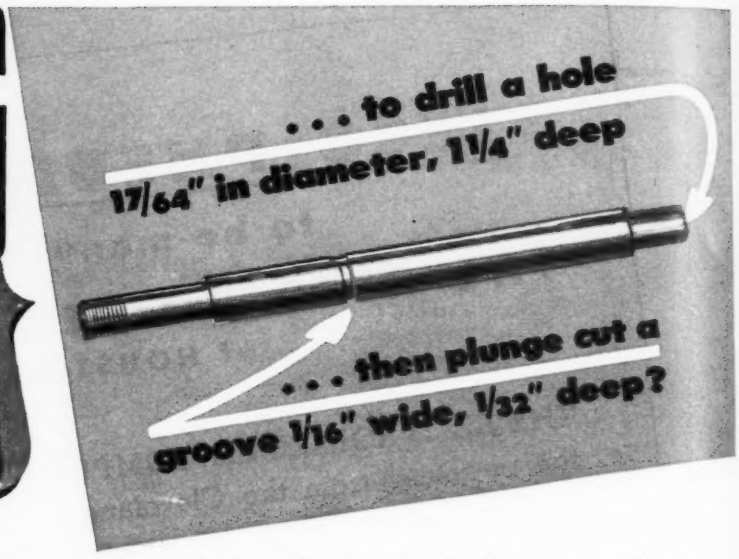


MAIN OFFICE AND PLANT, HOUSTON, TEXAS

Cleco PNEUMATIC TOOL DIVISION
of THE REED ROLLER BIT COMPANY
P. O. BOX 2119 • HOUSTON 1, TEXAS

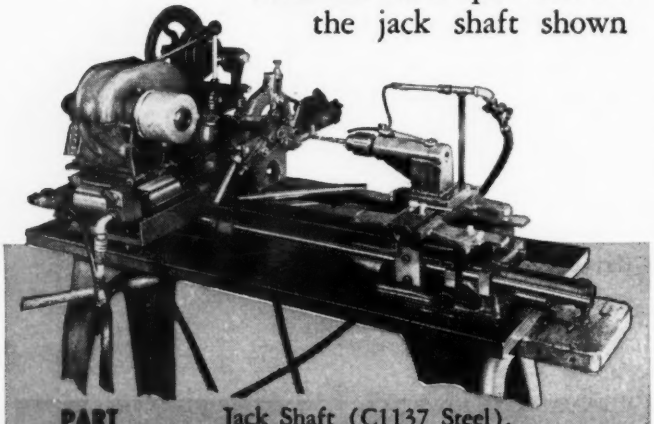
Manufacturers of the CLECO Line of Pneumatic Tools for Modern Industry

HOW LONG should it take



Critical analysis of repetitive operations, plus a little ingenuity, goes a long way towards helping maintain profits fast being eliminated by rising wage and material costs.

Take the twin operation on the jack shaft shown above. By hand, with the lead screw working the turret, one operator produced approximately 80 pieces per hour, 600 per shift.



PART	Jack Shaft (C1137 Steel).
OPERATION	Drill 17/64" dia. hole 1¼" deep, plunge cut groove 1/16" wide x 1/32" deep.
MACHINE	Atlas Lathe, 42" size, Model TH-42, ½ h.p. motor, equipped with Bellows BCAM-5-90 Air Motor to feed the turret, and BCAM-5-25 Air Motor to feed the cross slide. Both Air Motors are equipped with CC-40 Hydro-Checks. One No. 645-2 Lubro Unit is used for the two motors.
FEED	.007"—.010" per revolution.
SPINDLE SPEED	650 R.P.M.
TOLERANCES	.002" on both operations.
COOLANT	Sunicut No. 105.
PRODUCTION	Former method—one operator produced 80 parts per hour working one machine. Now handles two machines, produces 200 parts per hour. 33% longer tool life.

At the suggestion of a Bellows Field Engineer, production experts at the Kooima Machine Works equipped the lathe with a Bellows Air Motor to feed the turret, and a second Bellows Air Motor to feed the cross slide. The thrust of both Air Motors is controlled by Bellows Hydro-Checks.

One operator now handles two machines with less physical effort than he formerly spent on one. The operator merely pivots from one machine to the other to load and unload the work piece. Manufacturing operations are entirely automatic.

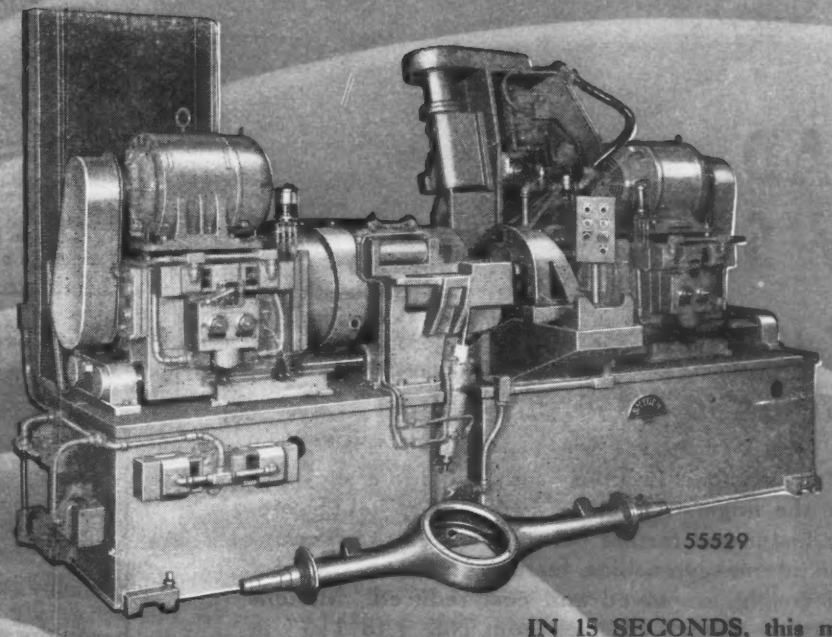
Production: 200 per hour, 1600 per shift. An increase of 250%.

The use of Bellows "Controlled-Air" Power to replace repetitive manual feeding, clamping and holding operations is today's quickest answer to lower unit costs. These versatile, inexpensive power units can be quickly applied to most standard or special machine tools. They usually pay for themselves with the first week's increased output.

Write today for Bulletin CL-10 and the new Foto Facts File

The Bellows Co.
ESTABLISHED 1911
Akron, Ohio

IT'S FAST
IT'S ACCURATE
IT'S AUTOMATIC
IT'S A SNYDER SPECIAL



IN 15 SECONDS, this machine clamps a heavy rear-axle housing in a fixture, drills 21 holes, and releases the work-piece. Guide-bar power units advancing from three different directions drill the holes in a fraction of the time required in a conventional set-up. Close tolerances are easily maintained because machine components, designed for a single operation, are simple in construction, rigid and dependable. No special operator skill or training is required.

For more than 22 years, the Snyder Tool & Engineering Company has been recognized as a leader in the field of special-machine construction. Snyder specials are used in every branch of the metal-cutting industries to boost production quotas, guarantee precision, reduce fixed operating costs.

There may be similar opportunities for improvement in your manufacturing process. Snyder engineers will analyse your requirements without obligation to you. *Snyder Tool & Engineering Co., 3400 E. Lafayette Ave., Detroit 7, Michigan.*

SNYDER

DESIGNERS AND BUILDERS OF MACHINERY FOR HIGH PRODUCTION AT LOW UNIT COST

22 Years of Successful Cooperation with Leading American Industries

UNBRAKO

Reg. U. S. Pat. Off.

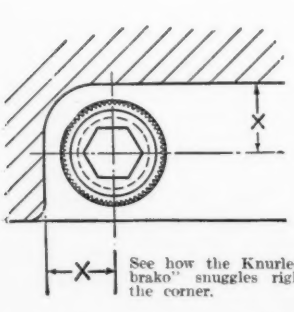
Knurling of Socket Screws originated with "Unbrako" in 1934.

KNURLED SOCKET HEAD CAP SCREWS

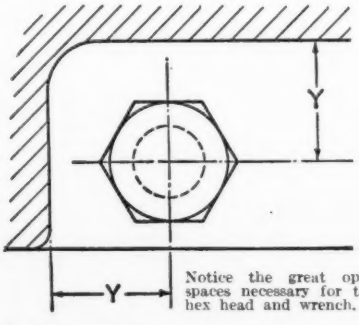
prevent lost motion therefore save assembly time

They speed assembly because their knurled heads provide a slip- and fumble-proof grip—be the fingers and head ever so oily—therefore, they can be screwed-in faster and farther before it becomes necessary to use a wrench. Their internal wrenching feature facilitates compact designs, so space, and weight are saved and cost reduced. Millions upon millions of these time-savers—in sizes from No. 4 to 1½" in diameter and in a full range of lengths—are being used throughout industry. Write for the "Unbrako" Catalog.

"UNBRAKO" AND "HALLOWELL" PRODUCTS ARE SOLD ENTIRELY THROUGH INDUSTRIAL DISTRIBUTORS.



See how the Knurled "Unbrako" snuggles right into the corner.



Notice the great open spaces necessary for the hex head and wrench.

OVER 44 YEARS IN BUSINESS

"UNBRAKO" SOCKET SET SCREW WITH KNURLED CUP POINT

The knurled cup point of this "Unbrako" makes it a Self-Locker, the points dig in and hold fast even when subjected to the most chattering vibration.

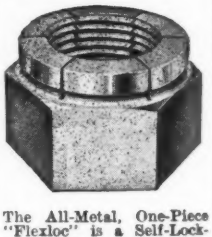
Pat'd and Pats. Pend.

"UNBRAKO" SOCKET SET SCREW WITH KNURLED THREADS

Knurling the "Unbrako" Socket Set Screw, as shown, awages the threads and an excellent Self-Locker is the result—For use where the points such as: flat, dog, cone and oval do not lend themselves to knurling.

Pat'd and Pats. Pend.

"FLEXLOC" SELF-LOCKING NUTS



The All-Metal, One-Piece "Flexloc" is a Self-Locking Nut that won't budge, except when a wrench is used. Every thread—takes its share of the load and being a "stop" nut it will stay locked in any position on a threaded member—"a real fastener", if ever there was one. Free samples.

Pat'd and Pats. Pend.

"HALLOWELL" KEY KIT

Pats. Pend.

You can't screw socket screws in or out without a hex socket wrench, so why not get our No. 25 or No. 50 "Hallowell" Hollow Handle Key Kit which contains most all hex bits.

STANDARD PRESSED STEEL CO.

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DoALL

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Faster Machining

Precision and high-speed sawing of all materials, metals, woods, plastics. Saw sizes and accessories to suit all requirements.

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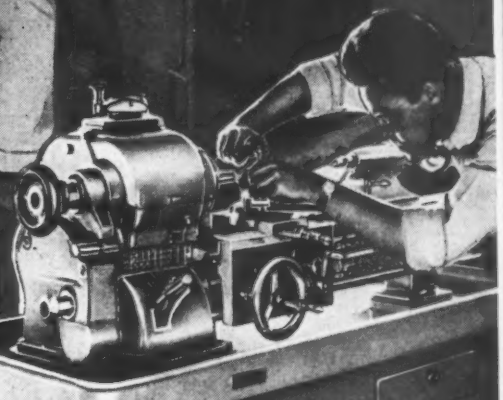

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ONE SOURCE SAVES YOU TIME AND EFFORT

DoALL Products *Include:*

- **CONTOUR SAWS:** 13 models; all prices. Low and high speeds, step or variable. Precision or high-speed cutting.
- **BAND SAW BLADES:** Razor-sharp, superhard teeth. No resharpening needed.
- **BAND FILING MACHINES:** 9 times faster than hand filing, 4 times faster than jig filing.
- **JIG FILING MACHINES:** For more intricate work. Perfectly straight filing.
- **FILES:** All kinds — file bands, jig files, rotary files, hand files.
- **SURFACE GRINDERS:** 6 models. Hydraulic, precision type for toolrooms and production. Also grinding wheels, magnetic chucks, cutting oils, coolant systems, dust collectors, etc.
- **SPOT WELDERS:** New "True-Pressure" type having straight up-and-down movement. No tip skidding.
- **HEAT-TREATING UNITS:** Compact, combination unit includes furnace, oven, quench tanks, automatic controls.
- **ELECTRONIC INSPECTION:** Automatic inspection, sorting and counting of small parts, twice as fast as manual methods.
- **BENCH PROFILERS:** For great variety of small work—profiling, milling, slotting, routing, etc.
- **PRECISION LATHES AND HAND SCREW MACHINES:** Various types for toolroom and production lines.
- **RADIUS SHAPER-MILLER:** 1 setup for many operations—has a thousand production uses.
- **VARIABLE SPEED DRIVES:** Smooth speed-changing drives. Infinitely variable.
- **GAGE BLOCKS AND INSPECTION INSTRUMENTS:** The finest for precision work.
- **TOOL-AND-DIE STEEL:** Non-warping, precision-ground up to 1 inch thick and 6 inches wide.

The DoALL *Company*

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...nd for free pictorial booklet "DoALL EQUALS TEN ...LUS" which compares fast, efficient Contour Machining ...th other metal-cutting processes. Shows how this miracle ...ethod of low-cost production makes great economies.

With **SUNNEN PRECISION HONING**
You Can Produce Holes with

Accuracy to .0001"

at Low Cost

Used on thousands of parts such as the examples shown here, the Sunnen Precision Honing Machine finishes parts quickly and more accurately than any other method. As a result parts last longer and there are fewer rejects — even when tolerances are as close as 1 to 2 ten thousandths.

Sunnen Precision Honing produces holes that are straight and true; corrects errors of taper and out-of-roundness; align-hones two or more holes of the same size; accurately duplicates sizes.

To hold very close tolerances on those "difficult" jobs — or produce better than usual finishes — the Sunnen Precision Honing Machine will do the job rapidly and economically.

For complete details write for Bulletin XMAN 5000, or ask a Sunnen engineer to call and show you how Sunnen Honing can be used in your plant.

- Size range—.120" to 2.625" in diameter.
- Operates in any metal or plastic except lead and babbitt.
- Set it up in one minute — easy to use.
- Low in cost — economical to operate.
- No jigs or fixtures needed — no chucking distortion.
- Does not require skilled labor.

SUNNEN PRODUCTS COMPANY
7940 Manchester Ave • St. Louis 17, Mo.
Canadian Factory: Chatham, Ontario

SUNNEN

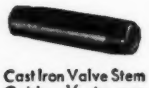
205

The Sunnen Precision Honing Machine is used on parts like these . . .

Shell Loading Die.

Carbureter Idler Pump. Smooth, straight-line finish in blind hole prevents piston leakage.

Aircraft Instrument Panel Control Wire Bushing. Hole .187" diameter—held to .0002", stock removal .001", sixty per hour.


Cast Iron Valve Stem Guide. ½ to one thousandth removed — 220 pieces per hour. Better finish and straighter hole.

Hydraulic Control Bushing. Honing gives straight round hole after rough reaming.

Bearing. A very small part. 2 micro-inch finish necessary.

Aircraft Hydraulic Brake Cylinder. Honing 3 times faster than lapping — and gave a straighter hole.

Bronze Valve. The Sunnen method of honing is used to secure a high finish and accuracy.

Compressor Yoke. Alignment maintained and better finish produced.

Hydraulic Two-Way Control Valve. Hole is honed to eliminate leakage.

Drawing and Blanking Die "Saves time in producing smooth base metal finish."

Mild Steel Clevis. Honing corrected errors of previous operations and maintained true alignment of two holes.

Miniature aircraft cylinder — smooth, accurate honing provides better compression and longer life.

Automobile Distributor Shaft Gears. Taper removed at a rate of 80-90 per hour.

Here's why Workmen like WELLS

METAL CUTTING BAND SAWS

The No. 8 showing new Wells Wet Cutting System—an economical accessory available for all No. 8 Wells Saws.

Specifications

CAPACITY:
Rectangular . . . . . 8" x 16"
(Special Guides) . . . . . 5" x 24"
ROUNDS: . . . . . 8" diameter
MOTOR: . . . ½ H.P., A.C. or D.C.
SPEEDS:
Selective 60, 90, 130 feet per minute
WEIGHT: . . Approximately 665 lbs.

You don't have to go through a lot of motions when you use a Wells Saw. Just place the material in position for cutting, give a turn to the hand wheel of the quick-acting vise, and you're ready to go. Hydraulic stabilizer on gravity feed and automatic shut-off take care of the rest. *No wonder the Wells is popular with users!*

From a management standpoint, it pays to provide workmen with these modern, efficient, versatile tools. Use them in stock rooms, machine shops, on maintenance jobs. Wells Saws do good work, cut close, remove minimum material. For production work, your Wells Saw can be equipped with the new Wells Wet Cutting System. Ask for complete information. See your local Wells representative or write.

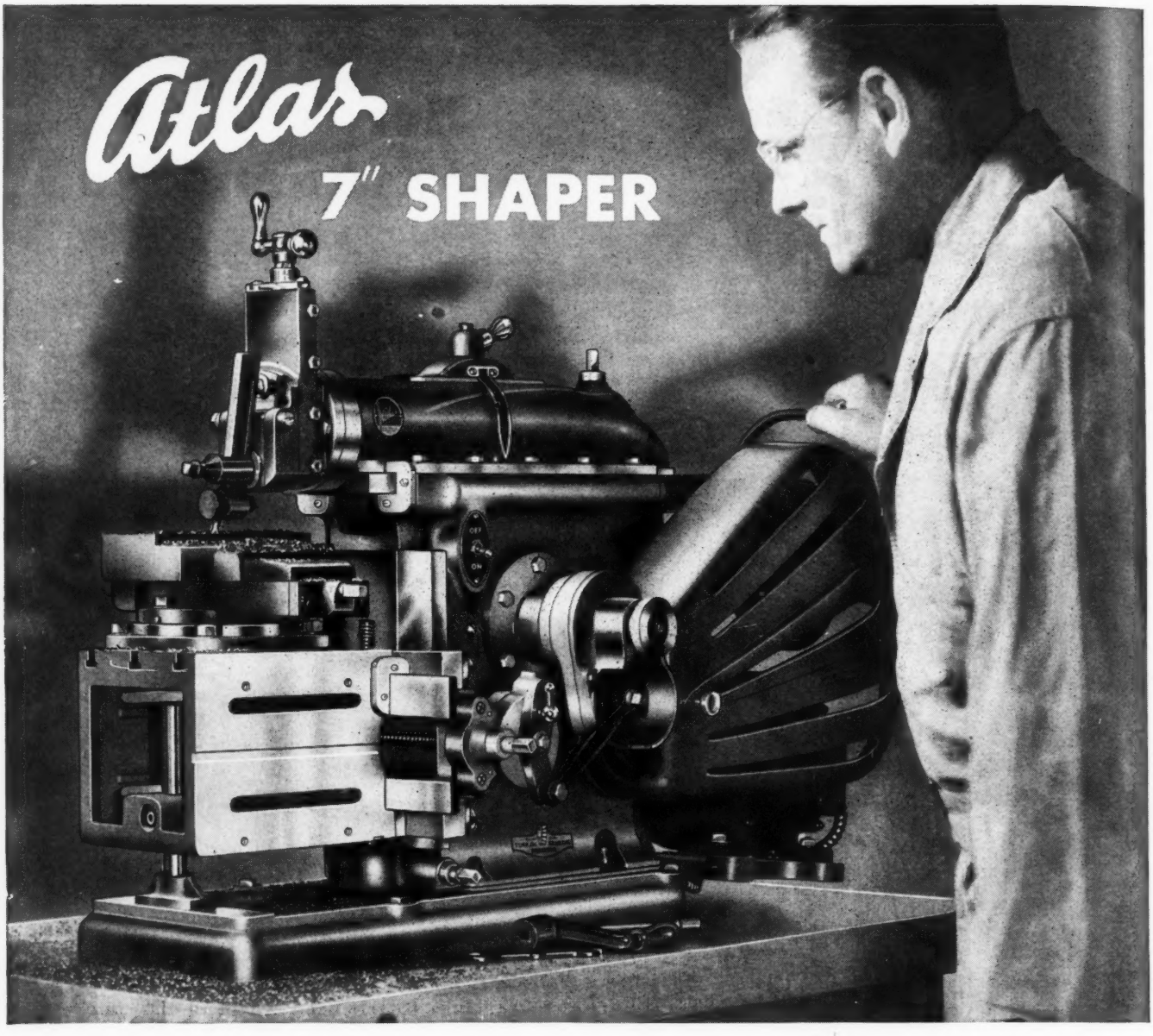
Wells SAWS
THE SIGN OF SERVICE

Wells

Products by Wells are Practical

METAL CUTTING BAND SAWS

WELLS MANUFACTURING CORPORATION
404 SOUTH GRANT, THREE RIVERS, MICHIGAN



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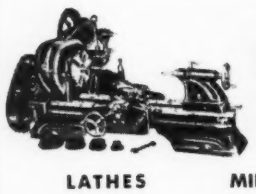
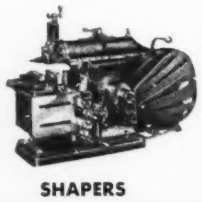

LATHES

MILLING MACHINES


SHAPERS

DRILL PRESSES

Atlas 4 TOOL TEAM

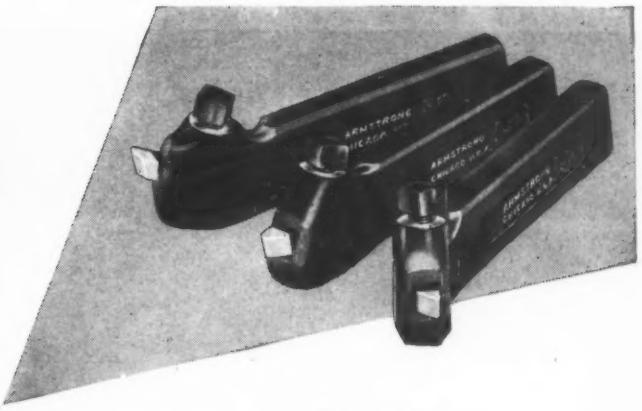
Most shaping operations in shop or tool room are within the 7" stroke of an Atlas shaper. That is why its compact size is such an advantage. It saves on set-up time, saves on machine hour cost, saves on power. Savings that quickly translate into profits.

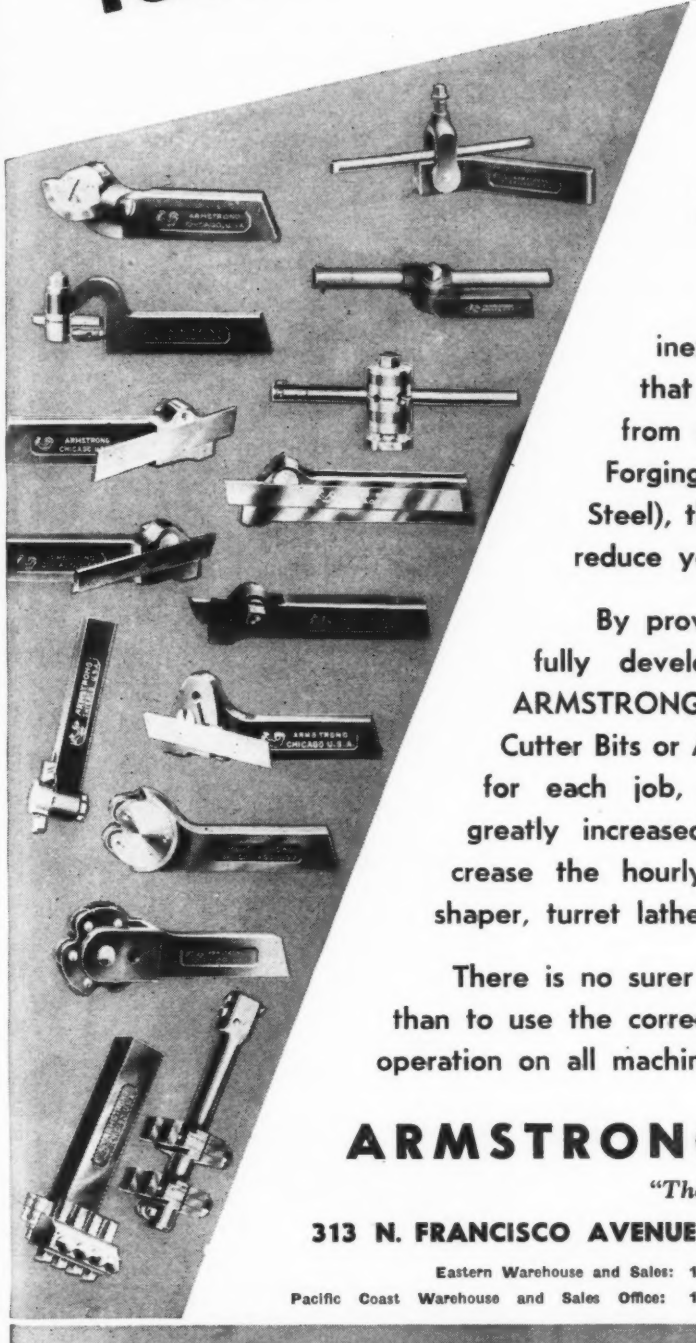
The Atlas shaper handles close tolerance work to perfection. Gives you a selection of cutting strokes between 45 and 186 per minute, speeds from 3½ to 116 fpm. It is Timken bearing equipped. Operates from ½ HP motor.

Send for catalog with complete specifications and operating details.

ATLAS PRESS COMPANY
653 N. PITCHER STREET, KALAMAZOO 13, MICH.

ARMSTRONG TOOL HOLDERS





answer both . . .

1. The problem of lowering costs

2. The problem of increasing output

By providing permanent, multi-purpose, inexpensive ARMSTRONG TOOL HOLDERS that use cutters or bits that are quickly ground from standard high speed shapes, (Saving: All Forging, 70% Grinding and 90% High Speed Steel), the Armstrong System of Tool Holders will reduce your tool cost to an absolute minimum.

By providing stronger more efficient tools, carefully developed for each operation, as well as ARMSTRONG High Speed Steel, ARMALOY Cast Alloy Cutter Bits or Armide Carbide-Tipped Cutters as required for each job, ARMSTRONG TOOL HOLDERS permit greatly increased speeds and feeds, enable you to increase the hourly output of every lathe, planer, slotter, shaper, turret lathe and screw machine.

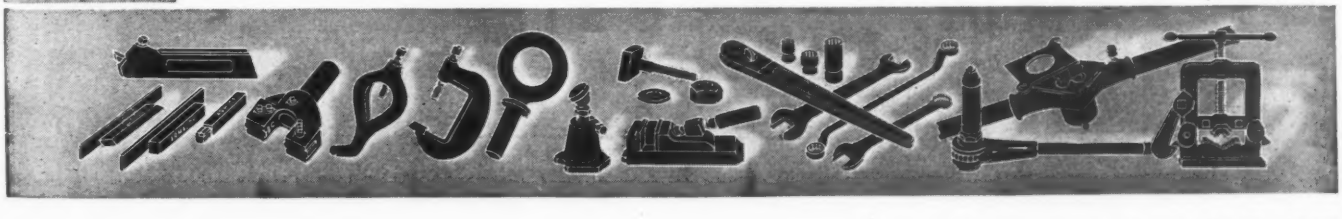
There is no surer way to lower costs and increase output, than to use the correct ARMSTRONG TOOL HOLDER for each operation on all machines.

ARMSTRONG BROS. TOOL CO.

"The Tool Holder People"

313 N. FRANCISCO AVENUE **CHICAGO 12, U. S. A.**

Eastern Warehouse and Sales: 199 LAFAYETTE STREET, NEW YORK 12, N. Y.
Pacific Coast Warehouse and Sales Office: 1275 MISSION STREET, SAN FRANCISCO 3, CALIFORNIA



Keep Cutters Sharp With the ACE

BEAT TODAY'S HIGH COST PRODUCTION

AN OLIVER OF ADRIAN PRODUCT

GRINDS DIFFICULT CUTTERS EASILY
(High Speed or Carbides)

Keep production cutters in top condition with the "ACE" . . . We recommend it for grinding face mills up to 15" . . . slitting saws . . . end mills . . . angular cutters . . . slab mills . . . dove tail cutters . . . reamers . . . taper reamers . . . gear cutters . . . double angle cutters. Fellows helical cutters . . . production gashing . . . **new uses found every day.**

The "ACE" is **simple, highly accurate,** and **physically easy to work with.** It saves setting-up time, only two fixtures are required to grind all types of cutters. Direct reading for clearance. No computation. **New in principle,** the "ACE" is already old in experience in hundreds of plants.

The "ACE" is tops with operators. Designed to prevent work fatigue—the work is always before the operator's eyes with **no bending—no stooping—no squinting.**

2 Models standard and Heavy Duty for Tungsten carbide tools.

OLIVER INSTRUMENT CO.

1410 E. MAUMEE STREET • ADRIAN, MICH.

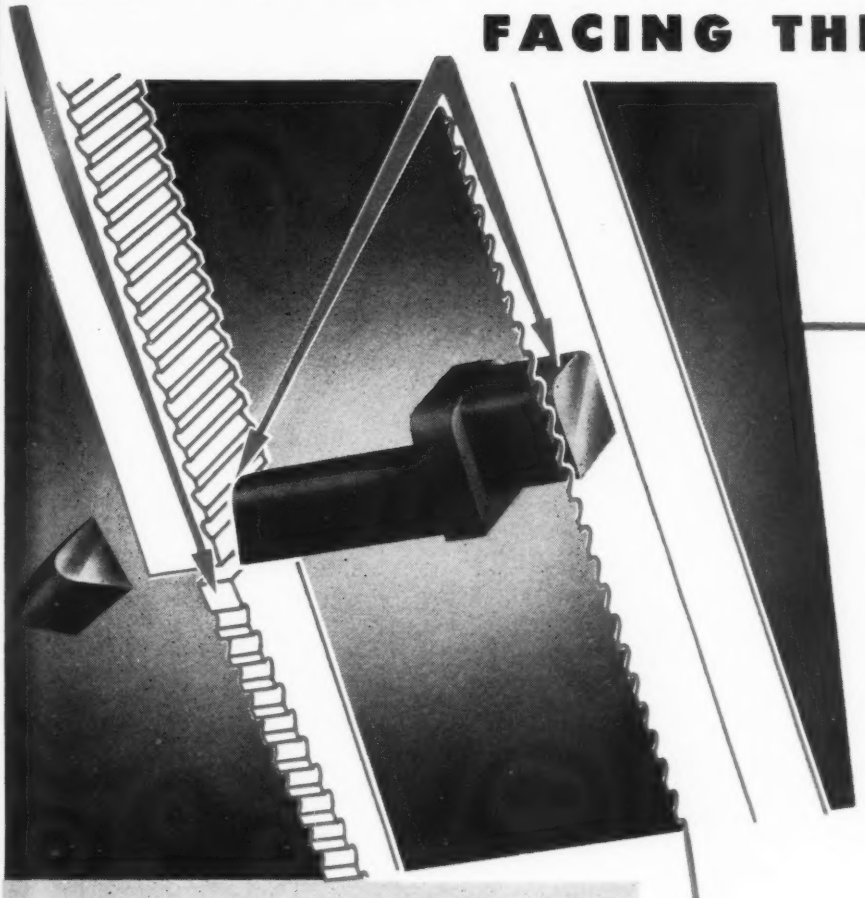
Write for Illustrated Literature

IMPROVE YOUR TOOLROOM
IT'S THE BACKBONE OF PRODUCTION

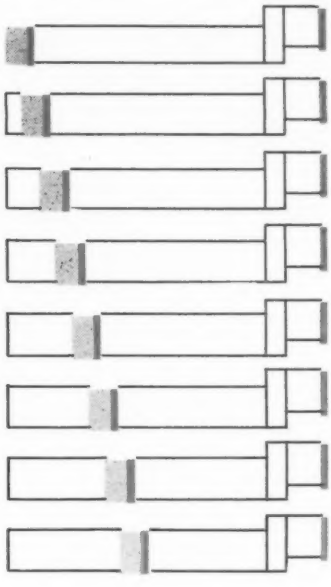
OLIVER OF ADRIAN

AUTOMATIC DRILL GRINDERS
TOOL & CUTTER GRINDERS—DRILL POINT THINNERS—TEMPLATE TOOL GRINDERS—FACE MILL GRINDERS—DIEMAKING MACHINES

BROACHING THROUGH TO LENGTH— FACING THE ENDS IN *One Stroke*



PART: Turbine Wheel Bucket
MATERIAL: Stainless Steel Forging
MACHINE: Vertical, Single Slide, 10-Ton Broach
LIMITS: ± .001
PRODUCTION: 300% Increase Over Previous Method



And **8 DIFFERENT PART LENGTHS** *broached* **FROM ONE FORGING—** *with one set-up*

Chances are you don't make steam turbines or turbine wheel buckets. But if you are cutting metal, *and want to do it fast—broach it.*

"300% production increase over previous method." These are typical results when broach tooling, designed and built by Detroit Broach, is put on the job . . . worthwhile results in today's struggle with higher production costs.

Detroit Broach will gladly consult with you and determine actual cost and production facts on your applications no matter what type of broaching is required. Write today.

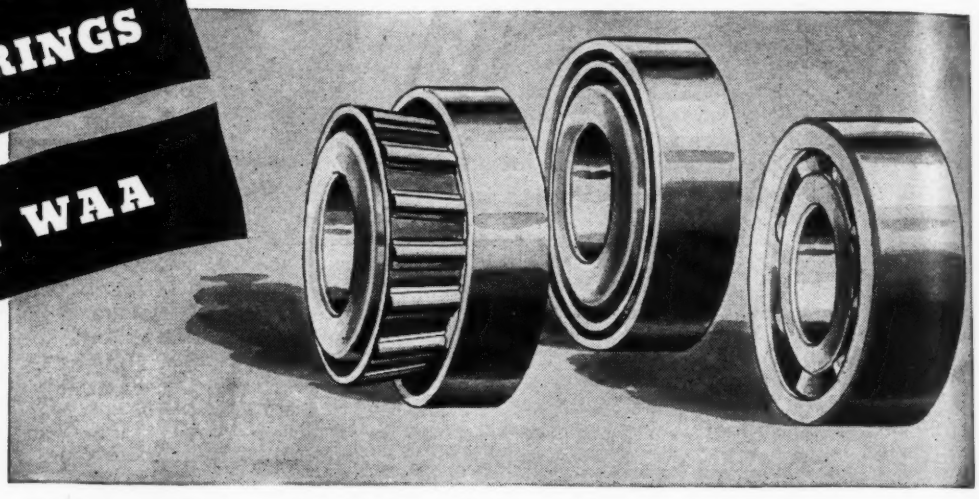
MEMBER BROACHING TOOL INSTITUTE

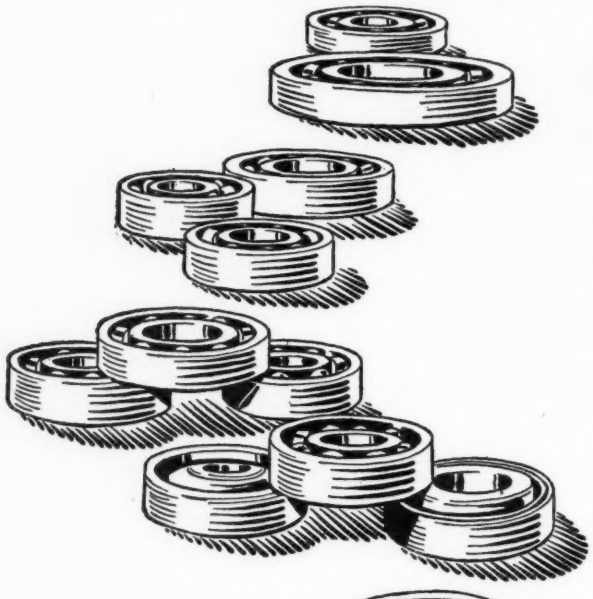
DETROIT *Broach* COMPANY

20201 SHERWOOD AVENUE • DETROIT 12, MICHIGAN

START ROLLING ON BEARINGS FROM WAA

SET YOUR OWN PRICE IN SEALED BID SALES





Get your bearings from the $18,000,000 stock now being sold by WAA. Friction and anti-friction bearings and components in all sizes and types are included in this stock. Many sizes are available in production-run quantities. Set your own price on what you need and submit your bid. Get all pertinent information from your nearest Customer Service Center or WAA Regional Office—go there to make your own inspection.

EXPORTERS! Your business is solicited. Much material which is surplus in the United States is urgently needed or is readily salable in other countries. Watch for other offerings, many of them may be of interest to your clients.

Sales of bearings will be held at frequent intervals. To receive information on future sales, write, wire or phone the Regional Offices listed below asking that your name be placed on their mailing lists.

CINCINNATI • CHICAGO • ST. LOUIS • DETROIT
KANSAS CITY, MO. • CLEVELAND
LOS ANGELES • NEW YORK

OFFICE OF GENERAL DISPOSAL

WAR ASSETS ADMINISTRATION

GOVERNMENT WAA SURPLUS

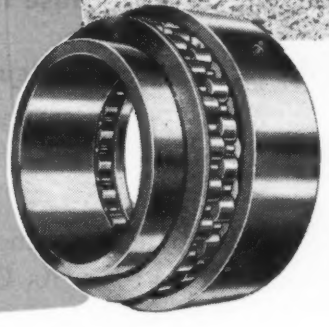
Offices located at: Atlanta • Birmingham • Boston • Charlotte • Chicago
Cincinnati • Cleveland • Denver • Detroit • Grand Prairie, Tex. • Helena • Houston
Jacksonville • Kansas City, Mo. • Los Angeles • Louisville • Minneapolis • Nashville
New Orleans • New York • Omaha • Philadelphia • Portland, Ore. • Richmond
St. Louis • Salt Lake City • San Antonio • San Francisco • Seattle • Spokane • Tulsa

1186

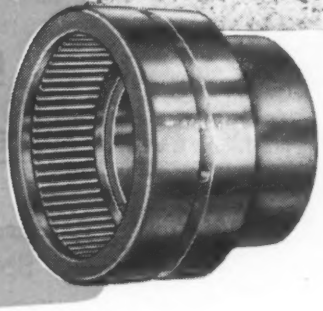
Today's High Speed Excavating Calls for *Bearings That Stand Up!*

Capable of making as many as five digging cycles a minute the ⅜-yd. Bucyrus-Erie 10-B is really a fast shovel, and one that stands up to tough digging, too. Widespread use of roller bushings and bearings is essential to both speed and ruggedness.

ORANGE "STAGGERED" ROLLER BEARINGS



ORANGE ROLLER BUSHINGS



Orange "Staggered" Roller Bearings have worked on 10-B drum shafts along with the Orange Roller Bushings. They combine extreme ruggedness with smooth, precision operation. The "staggered" roller arrangement distributes the load over many short rolls instead of a few full-length rolls as in conventional types. This assures an even running bearing of greater load carrying capacity. Full range of standard sizes interchangeable with other solid race type bearings.

Drum and transmission shafts of the Bucyrus-Erie 10-B have both been equipped with Orange Roller Bushings, whose internal clearances greatly reduce possibility of mis-aligned rollers—provide smoother, quieter running. Exceptionally high load-carrying capacity in small space permits compact design—provides ample overload margin. Orange Roller Bushings withstand severe stress and heavy loads with maximum life hours expectancy.

INVESTIGATE the advantages of Orange Roller Bushings and Orange "Staggered" Roller Bearings. Write for Engineering Data Books showing design, sizes, capacities, installation data, etc.

ORANGE ROLLER BEARING CO., INC.
552 Main Street, Orange, N. J.

—Mail Coupon for Engineering Data—

Orange Roller Bearing Co., Inc. M
Orange, New Jersey

Please send me your Roller Bushing and Staggered Roller Bearing Data Books.

NAME..... TITLE.....
COMPANY.....
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Finer Finishes at Roughing Speeds to *Meet Tomorrow's Competition . . . .*

LIPE *Carbo-Matic* LATHES

- **FEWER MAN HOURS** because it is entirely automatic.
- **FEWER MACHINE HOURS** because it is super-powered for speed.
- **FEWER REJECTS** because it is super-rigid for accuracy.

Finer and finer finishes at faster and faster speeds! Speed that is not lost through time lags in loading, unloading and operating—or through high scrap losses and rejects!

Those are competitive factors you'll have to reckon with tomorrow. And worn-out or over-age lathes won't face up to them. They'll cost you more in lost production, spoilage of product and poor workmanship than new Lipe Carbo-Matic Lathes will cost you.

The Lipe Carbo-atic was designed and built for carbide tools and for tight limits of finish and accuracy at roughing speeds. Super fast, rigid as a rock, its Cone worm gear and multiple V-belt drive gives a smooth chatterless cut, hogging off metal to rough-grinding tolerances on the first pass. Fully automatic, even on complex cycles, it permits battery operation and reduces loading and unloading time to a minimum. A heavier base, over-size motor, accessible controls and other modern features make it the tool of tomorrow.

NOW AVAILABLE for IMMEDIATE DELIVERY

LIPE ROLLWAY

LIPE-ROLLWAY CORPORATION
Syracuse 5, N. Y.

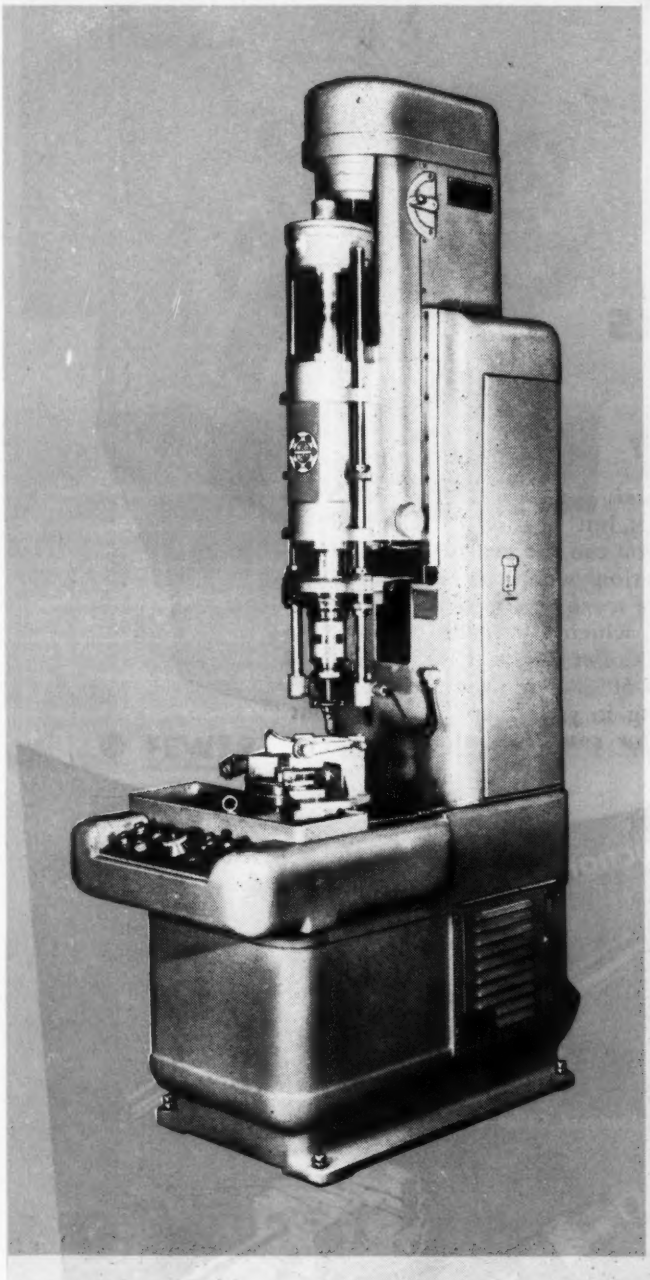
6-TON thrust loads and 1-TON radial loads can't budge tools gripped in UNIVERSAL COLLET CHUCKS

Universal Collet Chucks grip tools TIGHT! They hold end mills, taps, drills, and reamers positively rigid under 6-TON THRUST LOADS and 1-TON RADIAL LOADS. Special design produces *precisely equalized gripping power*—not at just a few points, but ON A CONTINUOUS SURFACE. That means you can use heavier feeds and greater speeds in your machining operations when you use Universal Collet Chucks—*you can turn out more work in less time.* Universal Collet Chucks grip tool flutes, permit stubbing, which eliminates cutting drills, thereby increasing profits. The Universal Collet Chuck is tightened so easily that LOCKING EFFORT IS REDUCED 50%. For faster, more accurate milling, drilling, reaming, and tapping in your plant, it will profit you to use Universal Collet Chucks. *Write for complete information.*

UNIVERSAL ENGINEERING COMPANY • **FRANKENMUTH, MICHIGAN**

the greeks had NO WORD for it

"Precisionizing"



definition:

BETTER PRECISION MACHINING AT LOWER COST . . . BY MEANS OF

MICROHONING

The *quicker, better, lower cost method,* Micromatic "Precisionizing" includes automatic sizing, high stock removal and generation of a round and straight bore. As the piece is MICROHONED, it is automatically gauged during the operation. When correct size is reached, MICROHONING is automatically halted. Precision is within .0002" to .0005" in fast production.

Significant reduction of processing time—increase in production—reduction of rejects and scrap—make very important savings in costs. Because the skill is built into the machine, there is much less dependence on the human element. A better product is obtained along with the lower cost.

Write for INFORMATION ON THE "PRECISIONIZING" PROCESS AS IT AFFECTS YOUR OPERATIONS

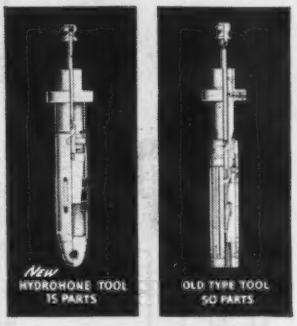
MICROMATIC HONE CORPORATION

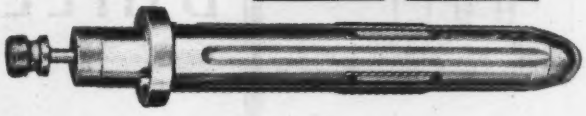
DETROIT 4, MICHIGAN

MACHINES • TOOLS • FIXTURES • ABRASIVES

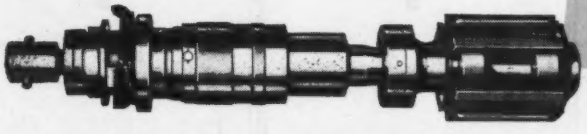
LOS ANGELES, CALIF. • HOUSTON, TEXAS • ROCKFORD, ILL. • NEW HAVEN, CONN. • BRANTFORD, ONT.

NEW MICROMATIC MICROMOLD TOOLS





Comprising simpler, stronger construction—rigid expansion cone—MICROMOLD abrasive sticks for use with MICROSIZE Automatic Control. For use on MICROMATIC HYDROHONER *Spindles*. Work diameter range ¼″ to 2″.

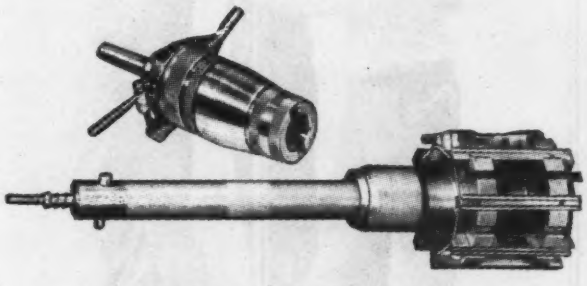


MICROMATIC AUTOMATIC TOOLS

Automatically controlled specific purpose high production tools. Sizes ¾″ bore and upward.

MICROMATIC HYDRAULIC TOOLS

Hydraulically controlled for bore sizes ¾″ and upward. Specific purpose tools.



MICROMATIC HYDROBRAKE TOOLS

For use in bores 1″ diameter upward—on either mechanical expansion or hydraulic expansion machines.

PRECISION CONTROL is CLOSER and PRODUCTION FASTER with Micromatic Microhoning Machines, Tools, Fixtures and Abrasives

MICROMATIC HONE CORPORATION makes a wide variety of tools—standard and special—to MICROHONE bores from ¼" to 41" diameter; for any length up to 75 feet. External MICROHONING tools for cylindrical surfaces are also furnished. Controls available for abrasive feed include automatic hydraulic —automatic mechanical, and manual.

MICROMATIC HONE CORPORATION
DETROIT 4, MICHIGAN
MACHINES • TOOLS • FIXTURES • ABRASIVES
LOS ANGELES, CALIF. • HOUSTON, TEXAS • ROCKFORD, Ill.
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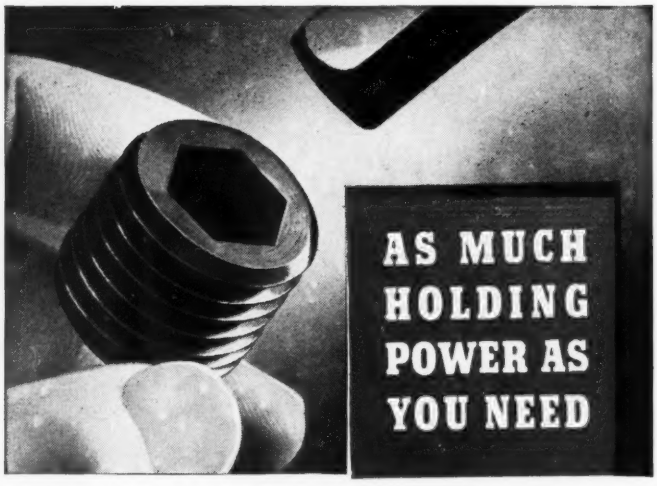


Whether a "hex" socket screw is right for your fastening, or—because of small size of components, vibration conditions or ease of disassembly—the BRISTO "Multiple-Spline" is needed, you get *maximum strength* from Bristol's "B-Line".

Both the "Hex" and "Multiple-Spline" socket screws represent careful, correct design by Bristol engineers. In addition, Bristol's system of raw material control *keeps* quality up to rigid standards. And Bristol's inspection methods, which include tests for hardness and ultimate strength, gauging for precision of lead and pitch—plus a final visual inspection before packing—result in "Hex" and "Multiple-Spline" screws that feature maximum strength . . . uniformity . . . accuracy.

For extra security—at no extra cost—select the right style from the Bristol "B-Line"—made by a manufacturer with 33 years' experience in socket screws. Order from your distributor. THE BRISTOL COMPANY, Mill Supply Division, 161 Bristol Road, Waterbury 91, Conn.

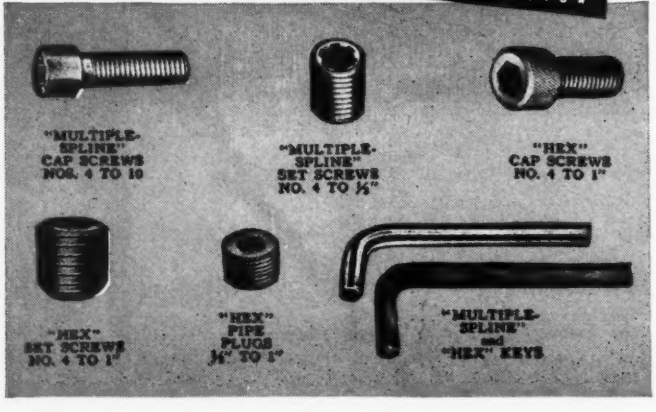
WHY "MULTIPLE-SPLINE" MEANS TIGHTER

NO EXPANDING PRESSURE: THE KEY PULLS THE SCREW AROUND

BRISTO SET & CAP SCREWS

Only the "B-LINE" has the right socket screw for every application

The BRISTOL Company
MILL SUPPLY DIVISION


"MULTIPLE-SPLINE" CAP SCREWS NOS. 4 TO 10
"MULTIPLE-SPLINE" SET SCREWS NO. 4 TO ½"
"HEX" CAP SCREWS NO. 4 TO 1"
"HEX" SET SCREWS NO. 4 TO 1"
"HEX" PIPE PLUGS ⅛" TO 1"
"MULTIPLE-SPLINE" and "HEX" KEYS

DEEP HOLE DRILLS

GUN DRILLS | **SPADE DRILLS**

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Deep-hole Drill Specialists

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We invite You to Consult us

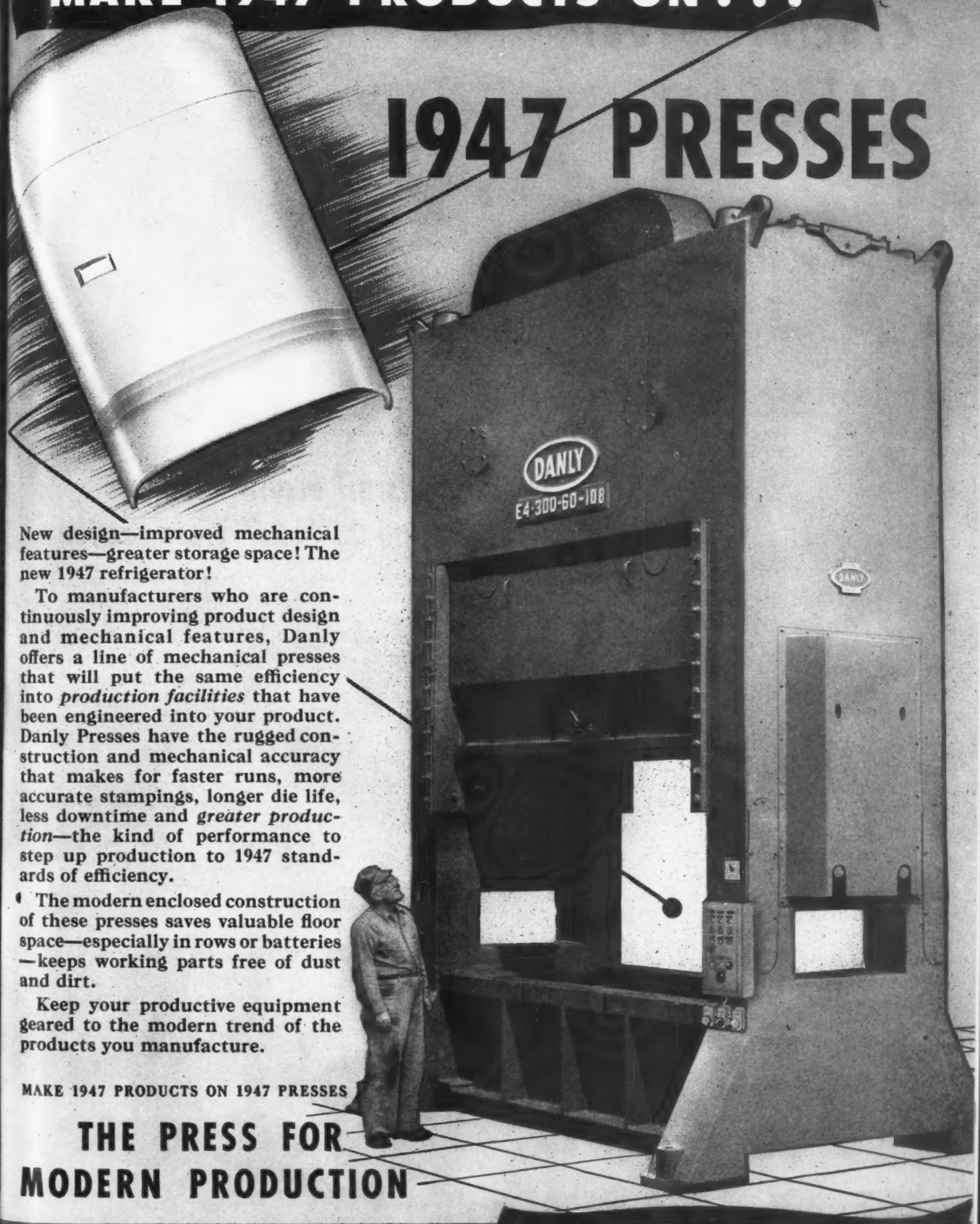
Conner

TOOL & CUTTER COMPANY

1000 EAST McNICHOLS ROAD • DETROIT 3, MICHIGAN

MAKE 1947 PRODUCTS ON . . .

1947 PRESSES



New design—improved mechanical features—greater storage space! The new 1947 refrigerator!

To manufacturers who are continuously improving product design and mechanical features, Danly offers a line of mechanical presses that will put the same efficiency into *production facilities* that have been engineered into your product. Danly Presses have the rugged construction and mechanical accuracy that makes for faster runs, more accurate stampings, longer die life, less downtime and *greater production*—the kind of performance to step up production to 1947 standards of efficiency.

The modern enclosed construction of these presses saves valuable floor space—especially in rows or batteries—keeps working parts free of dust and dirt.

Keep your productive equipment geared to the modern trend of the products you manufacture.

MAKE 1947 PRODUCTS ON 1947 PRESSES

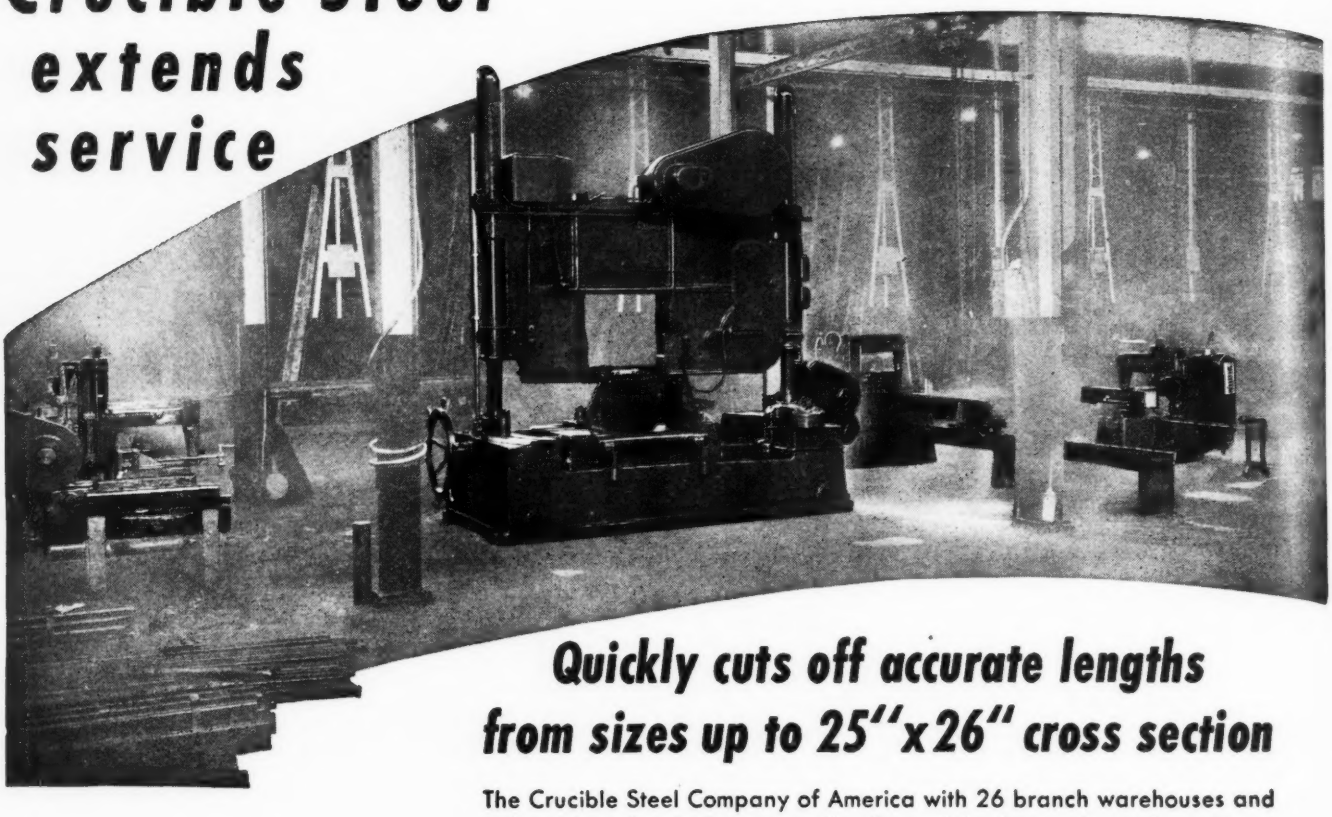
THE PRESS FOR MODERN PRODUCTION

DANLY
MACHINE SPECIALTIES, INC.

2100 S. 52nd Avenue • Chicago 50, Illinois

This 300-ton 4-point press is typical of the Danly line of one, two and four point models which range in size from 100 tons up—special sizes and adaptations built to customer specifications.

Crucible Steel extends service



Quickly cuts off accurate lengths from sizes up to 25"x26" cross section

The Crucible Steel Company of America with 26 branch warehouses and sales offices, has built a reputation for anticipating customers' needs, not only in high grade and special steels, but in service requirements as well. They were among the first to equip several of their warehouses with modern high speed MARVEL Saws (No. 6 and 9A series) in order to give fast service on either single lengths or large quantities of identical pieces, accurately cut from bars up to 10" x 10" cross section. Now in anticipation of new demands for larger sizes, they are the first steel company to install a No. 24 MARVEL Hydraulic Hack Saw in order to give fast service on orders for steels of any type *in sizes up to* 25" x 26" cross section.

This giant hack saw, which almost qualified as a "secret weapon" because it contributed so materially to our production capacity in building naval ordnance, applies an entirely new principle of reciprocation that has made "hacksawing" of large work practical for the first time.

Whatever your metal sawing problems, there is a MARVEL Saw exactly suited to your needs. A MARVEL field engineer will be glad to go over your metal sawing problems with you.

No. 24 MARVEL giant Hydraulic Hack Saw. (capacity 24" x 24"). Employs new "Roll Stroke" sawing action and trouble-free low pressure hydraulic control.

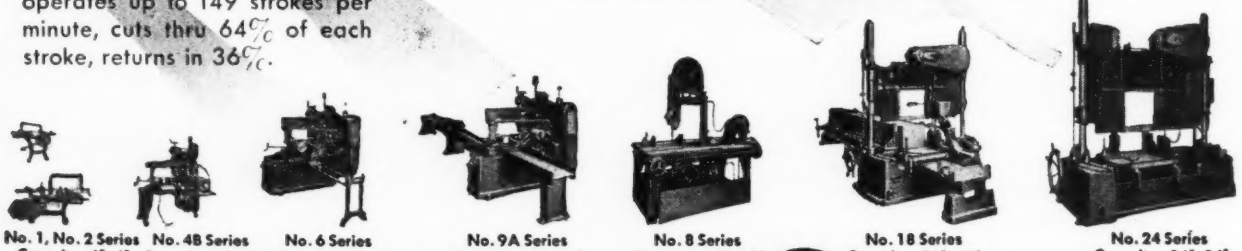
No. 9A MARVEL Production Saw (capacity 10" x 10"). Automatically feeds, measures and cuts-off identical lengths from single or nested bars with no more operator attention than an automatic screw machine.

No. 6 MARVEL Saw (capacity 6" x 6"). A high-speed, heavy-duty, all-ball-bearing saw—operates up to 149 strokes per minute, cuts thru 64% of each stroke, returns in 36%.

ARMSTRONG-BLUM MFG. CO.

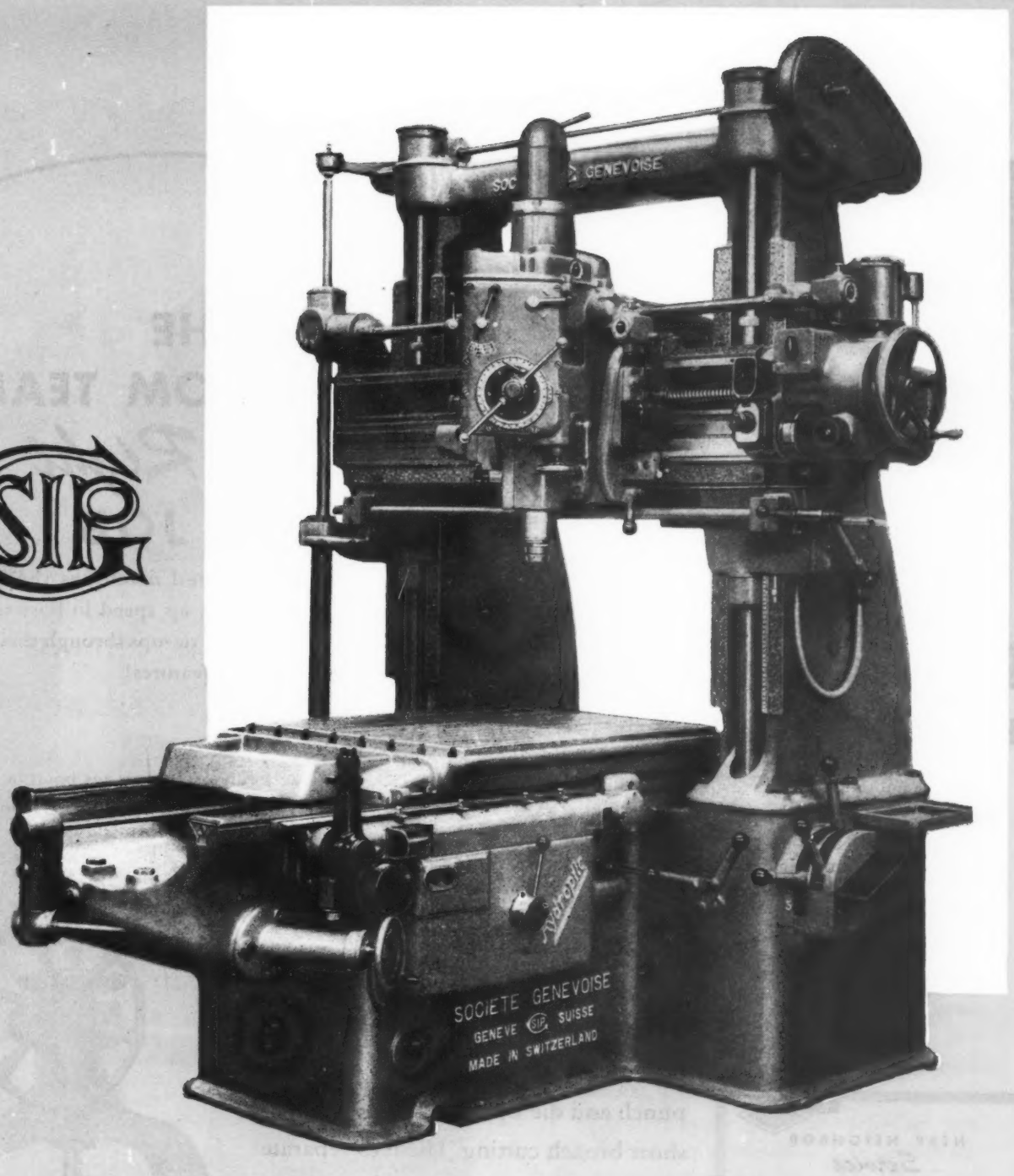
"The Hack Saw People"

5700 BLOOMINGDALE AVENUE, CHICAGO 39, U.S.A.



No. 1, No. 2 Series Capacity: 4"x4" Capacity: 6"x6" — No. 4B Series Capacity: 6"x6" — No. 6 Series Capacity: 6"x6" — No. 9A Series Capacity: 10"x10" — No. 8 Series Capacity: 18"x18" — No. 18 Series Capacity: 18"x18" — No. 24 Series Capacity: 24"x24"

MARVEL SAWS



HYDROPTIC-B

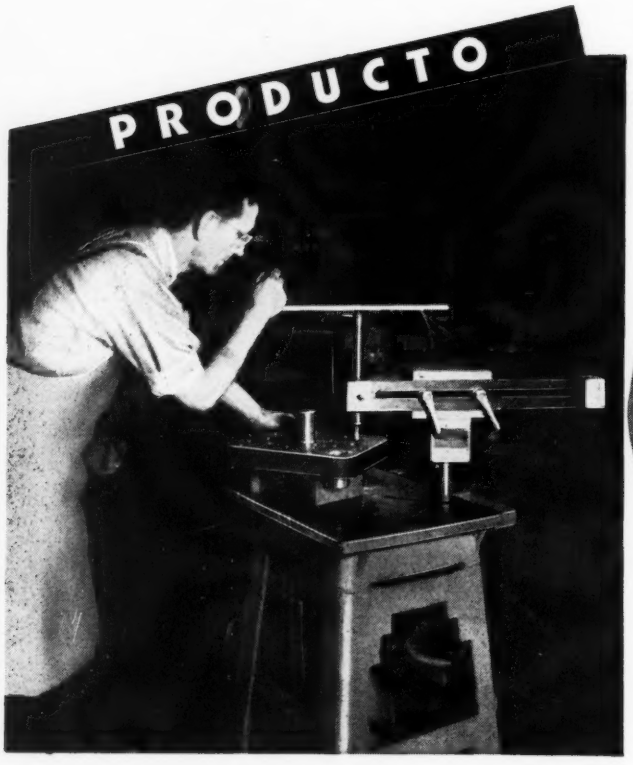
Boring
Drilling
Milling and
Measuring

Milling can be performed on this machine as well as boring and drilling. Special milling cutters for slotting and surfacing have been developed for use with the Hydroptic-B, and a depth measuring device adds still further to its versatility. A built-in optical measuring system, which is free from wear and mechanical stress, insures the accuracy of the Hydroptic-B. This machine is famous throughout the world as the most reliable basis of accuracy for all shop measuring and machining.

Guaranteed Accuracy for All Settings of Work Table and Spindle Head . . . 0.0002"

COSA CORPORATION

624 Chrysler Building, New York 17, N. Y.



Suggests

THE TOOLROOM TEAM THAT'S *Right* ON THE JOB

Here are two associated machines that team up effectively for stepping up speed in busy toolrooms ... preventing schedule tie-ups through their unusual versatility. Check the features!

THE HAND TAPPER

There's nothing more annoying to tool and die men than to be limited by their equipment to a small range of hand tapping and reaming operations. Producto has overcome these objections to a marked degree ... providing facilities to tap at any point in the work within the table area. Two bench types, capacities up to ¼" and ½" taps; Pedestal type, up to 1" taps ... money-makers with long service life.

THE UTILITY PRESS

Here's a screw press that gives the operator easy, precise control of up to 50 tons of pressure ... for a variety of punch and die operations ... and even short broach cutting. Use it to separate Punch and Die Holders on post die sets, preventing damage by hammers or pry bars. Can't give all features here ... send for details ... it's practically indispensable in all shops.

CHECK PRODUCTO FOR THE BEST IN TOOL AND DIE EQUIPMENT

NEAR NEIGHBOR *Service*

PHILADELPHIA 40, PA. Wright & Gade Tool Co. Radcliffe 5-1467	**BUFFALO 2, N. Y.** R. C. Neal Co., Inc. Cleveland 1110
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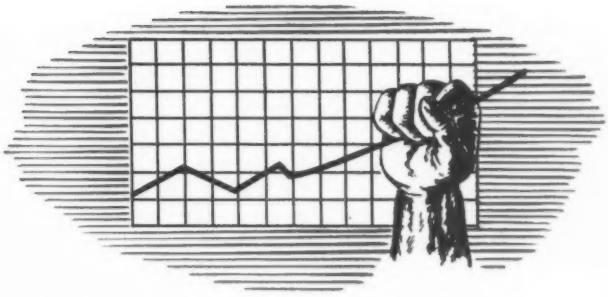
BALTIMORE 2, MD. L. A. Benson Co., Inc. Plaza 0340	**ELMIRA, N. Y.** R. C. Neal Co., Inc. 5168

THE PRODUCTO MACHINE COMPANY
BRIDGEPORT 1, CONN.
TEL. 4-9481



SPEEDING PRODUCTION with a 900-TON Push

Automatic feed, high speed production is not new or unusual in blanking operations—but when the blank is 27″ in diameter and the stock is .90 carbon steel, 3/16″ thick, it ceases to be an ordinary job. Clearing built this press to just those specifications, and the press is now delivering for its owner at 36 strokes per minute. Besides the blanking, the press cuts the scrap as it emerges, thus saving a separate operation and further reducing production costs.

Here's a 900-ton press working with the accuracy and speed you might expect in a much smaller machine. Clearing has been able to achieve results like this because from the day it was founded Clearing has refused to be hampered by conventional but unsupported beliefs. That's why you'll find Clearing presses in the most modern, most efficient plants throughout the world. It's also why a Clearing press is invariably a profitable investment.

Whatever your problem—whether you require a giant machine or a small inclinable press—put your facts and requirements in the hands of Clearing engineers for the most satisfactory and profitable answer.

MECHANICAL AND HYDRAULIC PRESSES ★ 45 TONS CAPACITY AND LARGER

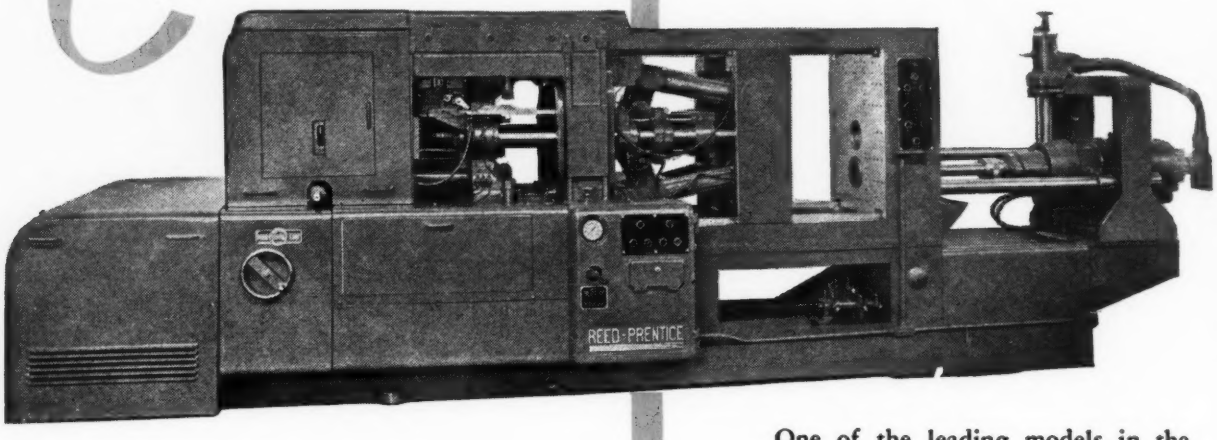
CLEARING

THE WAY TO EFFICIENT MASS PRODUCTION

CLEARING MACHINE CORPORATION

6499 WEST 65TH STREET • CHICAGO 38, ILLINOIS

☆A *Complete* LINE TO CUT



BEAT COMPETITION BY DIE-CASTING WITH REED-PRENTICE MACHINES

One of the leading models in the Reed-Prentice die casting line is the #3G — a high pressure, cold chamber machine for casting aluminum, magnesium or brass alloys. The #3 model, equipped with high pressure gooseneck and furnace, is designed for casting zinc, tin or lead base alloys. The #3 handles 20 lbs. of zinc; the #3G, 9 lbs. of aluminum per shot. Cold chamber and furnace attachments are interchangeable.

The Department of Commerce states, "Business is on the verge of a period of intense competition and businessmen should begin now to seek ways of reducing their costs and lowering their prices."

Alert manufacturers *are* cost conscious! That is why so many have turned to die castings to reduce manufacturing expense. Original equipment manufacturers in the metal working field are reporting savings up to 400% or better in the cost of many parts. If you are not getting the benefit of these tremendous savings — investigate die casting — then call on Reed-Prentice for the best in die casting machines!

These machines are simple to operate . . . will increase production with faster cycles and uninterrupted performance! Strong, non-porous castings eliminate machining operations — a substantial portion of parts cost. Better castings, increased production and lower unit cost will permit you to maintain your position in today's competitive market!

The complete line of Reed-Prentice die casting machines includes a model for every requirement — #1, #1½, #2, #2½ and #3 for casting zinc, tin or lead base alloys; #1G, #1½G, #2G and #3G for casting aluminum, magnesium or brass alloys. To further assist you Reed-Prentice offers facilities for die design, engineering and manufacture. We invite your inquiry for full information — mail coupon NOW!

MAIL COUPON NOW FOR FULL INFORMATION

Reed-Prentice Corporation, Dept. B
Worcester 4, Massachusetts

Please send full information on die casting machines as checked:
Model #1☐ #1G☐ #1½☐ #1½G☐ #2☐ #2G☐ #3☐ #3G☐

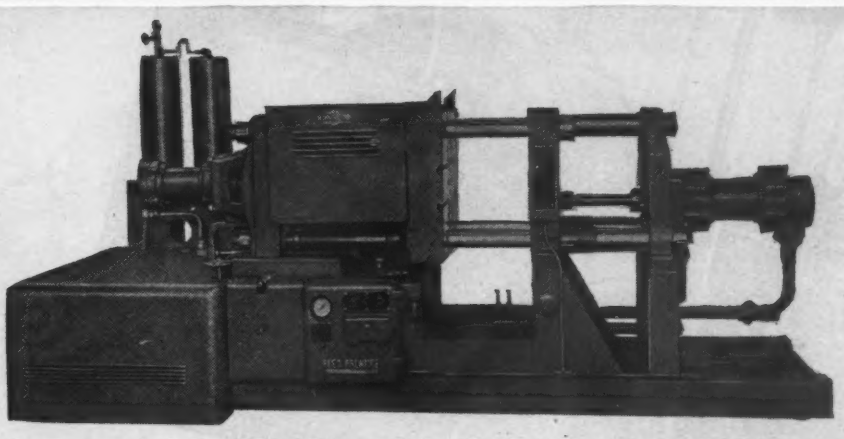
Name.....

Company.....

Address.....

DIE CASTING
REED-PRENTICE CORP.
WORCESTER MACHINES MASS., U.S.A.

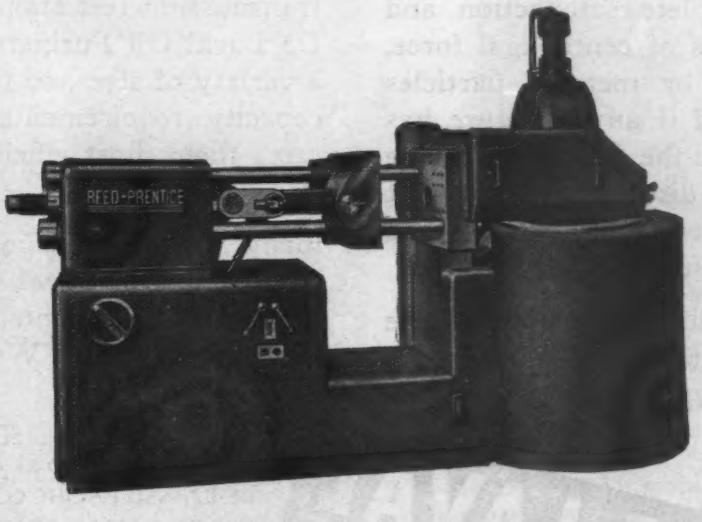
MANUFACTURING COSTS!



An economical Reed-Prentice model is the #1½G die casting machine with a high pressure, cold chamber for casting aluminum, magnesium or brass alloys. Also available, with high pressure plunger gooseneck and furnace, is the model #1½ for casting zinc, tin or lead base alloys. Cold chamber and furnace attachments are interchangeable. The #2 and #2G are similar in construction, utilizing larger die plates, tie bars and space between bars.

• SPECIFICATIONS •

	#1	#1G	#1½	#1½G	#2	#2G	#3	#3G
Size of die plates	16" x 21"	16" x 21"	28" x 29"	28" x 29"	38" x 36"	38" x 36"	30" x 30"	30" x 30"
Diameter of tie bars	3"	3"	3"	3"	4"	4"	Frame Type	Frame Type
Space between bars	12"	12"	15" x 18"	15" x 18"	24" x 24"	24" x 24"	29"	29"
Die Opens	8"	8"	10"	10"	12" - 16"	12" - 16"	16"	16"
Maximum die space	12"	12"	22"	22"	24" - 28"	24" - 28"	30"	30"
Capacity per shot (Lbs.)	4½ — zinc	2 — alum.	10½ — zinc	3¾ — alum.	15 — zinc	7 — alum.	20 — zinc	9 — alum.
Weight (Net Lbs.)	8,000	8,000	15,000	13,000	21,000	20,000	24,500	25,000



The #1 or #1G Models, with interchangeable furnace or cold chamber attachments are new Reed-Prentice developments to accommodate die casters with limited production. The same industry-proven features that characterize all Reed-Prentice machines are included in these models.

CLEVELAND
1213 West 3rd Street

NEW YORK
75 West Street

LOS ANGELES
2328 S. Santa Fe Ave.

Tests are more Reliable WHEN THE OIL IS Centrifuged

A DE LAVAL Oil Purifier enables test oil to be used over and over again with complete satisfaction and safety. By means of centrifugal force, it removes dirt or metallic particles from the oil, and if any moisture has found its way into the oil, it will remove and continuously discharge it. The test oil thus is kept clean and dry . . . hence maintains its usefulness longer.

De Laval machines need not be large on test oil purification. The model above has only moderate capacity — sufficient for the quantity of oil in the transmission test stand, of course. But De Laval Oil Purifiers are provided in a variety of sizes, so that whatever the capacity requirements, De Laval can meet them most efficiently.

Purification of test oil is but one of many time- and labor-saving applications for De Laval Oil Purifiers in metal-working plants. Bulletin MM-1 lists several others. Write for your copy.

DE LAVAL
PURIFIERS AND CLARIFIERS FOR FACTORY OILS

THE DE LAVAL SEPARATOR COMPANY
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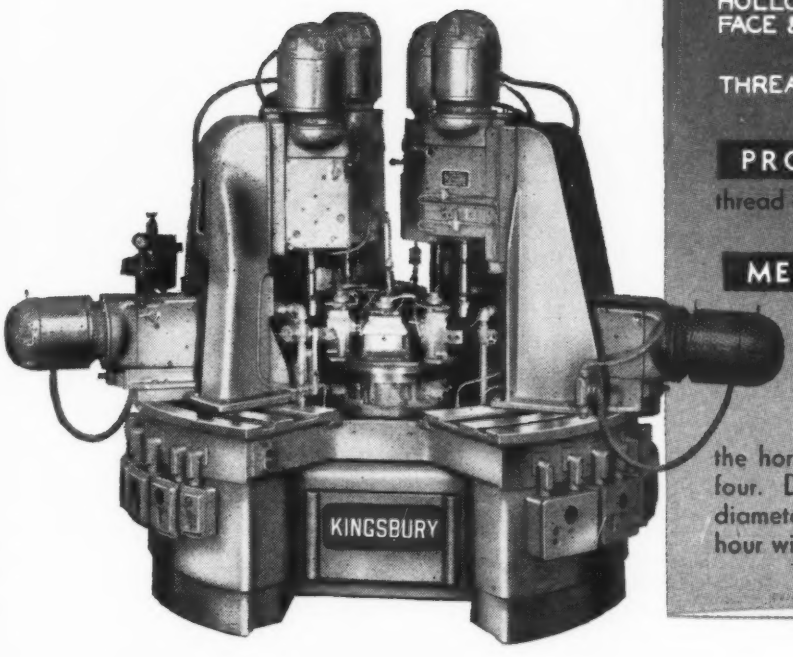
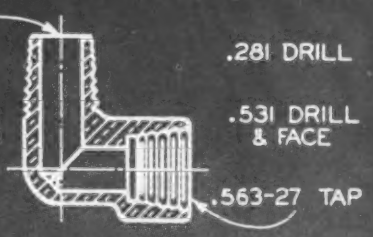
for GREATER OPERATING EFFICIENCY



BRASS ELBOW FORGINGS

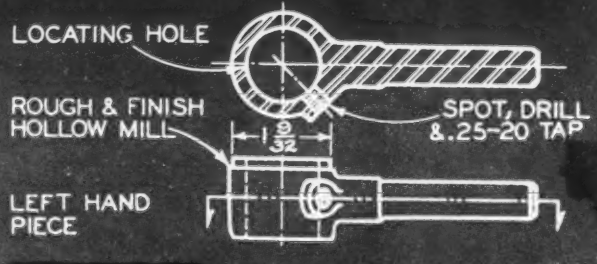


PROBLEM Drill, face, tap, hollow mill and thread 625 pieces per hour with one operator.

METHOD To meet this high production rate, the machine cuts the loading time with air-operated chucks. Drilling the holes in two steps keeps this operation well inside the required time cycle. Mounting vertical units on tunnel columns above the horizontal units reduces the working stations to four. Data: 20 in. index table, 5-stations. Base diameter 80 in. Gross Production: 785 pieces per hour with one operator.

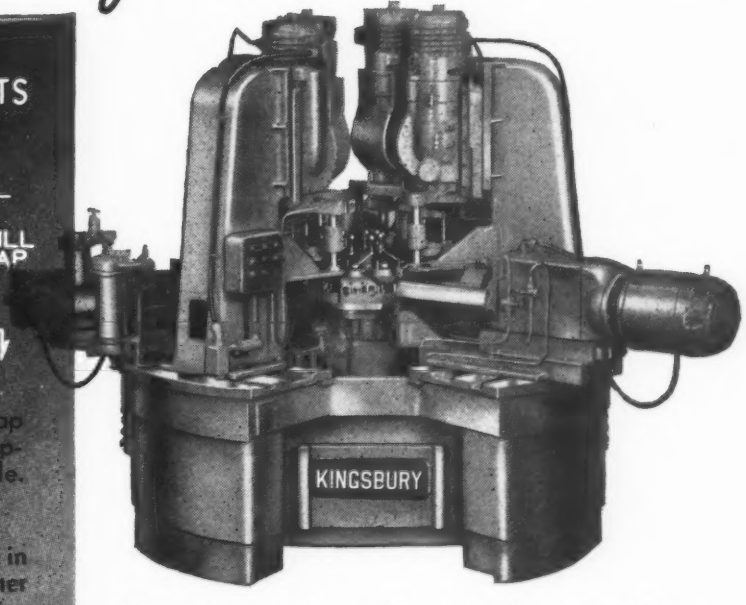
COMBINED OPERATIONS *for* HIGH PRODUCTION

FORGED STEEL TIE ROD SOCKETS



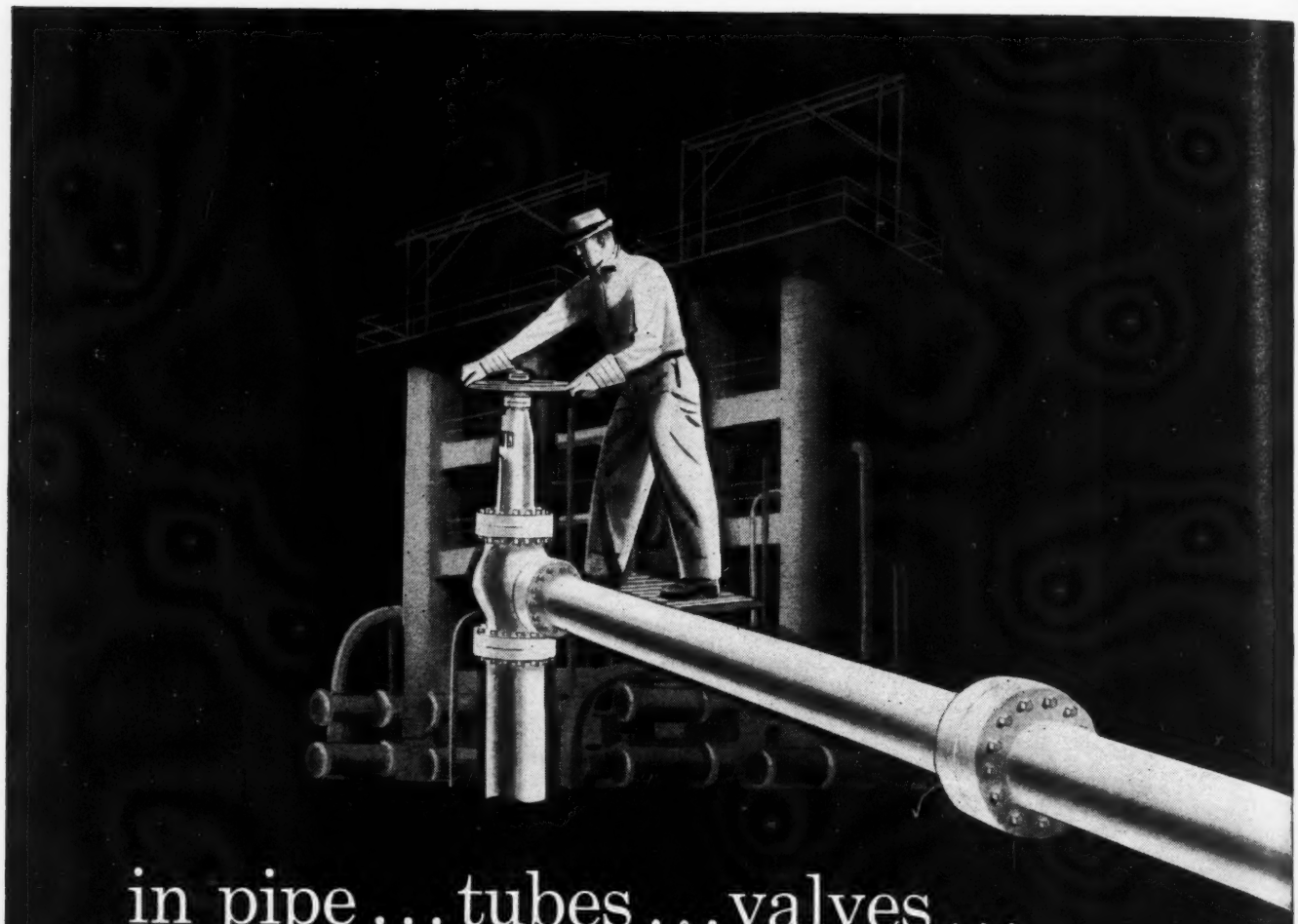
PROBLEM Hollow mill, spot, drill and tap 270 left or right hand pieces per hour with one operator. Hollow mill must be concentric with the hole.

METHOD By turning out lefts and rights in pairs, the machine has saved money for the customer in first cost and in change-over time. Double fixtures hold a right-hand and a left-hand part, with tapped holes parallel. Horizontal units with two spindle auxiliary heads spot, drill and tap each pair of parts. Separate hollow milling units operate vertically. Ball bearing guide bushings keep the hollow milling concentric with the guide hole. Data: 20 in. index table, 8-stations. Base diameter 80 in. Gross Production: 175 pieces of each hand per hour with one operator.



If you have similar problems, send us a print showing operations and hourly output. We will quote on a completely tooled machine, ready for use. It will have standard units up to 5 hp each and will do accurate work for years at intensive production. Kingsbury Machine Tool Corp., Keene, N. H.

KINGSBURY



in pipe . . . tubes . . . valves . . .

FOR HIGH PRESSURES — HIGH TEMPERATURES . . .

MOLYBDENUM gives added strength to wrought or cast ALLOYS . . .

In equipment for producing aviation gasoline and synthetic rubber . . .

In gas turbine and jet-propulsion engines for marine or aeronautical use . . .

In many of the most exacting applications, pipe, tubing, valves, controls, heat exchangers are fortified against high pressures, high temperatures or both by employment of Molybdenum-alloyed steels and irons.

Very small additions of Molybdenum, either alone or combined with other alloying elements in exactly right proportions, impart the physical properties for newly developed requirements.

On these and other uses of Molybdenum, Tungsten and Boron, the Molybdenum Corporation has informative literature and invites correspondence.

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CORPORATION OF AMERICA

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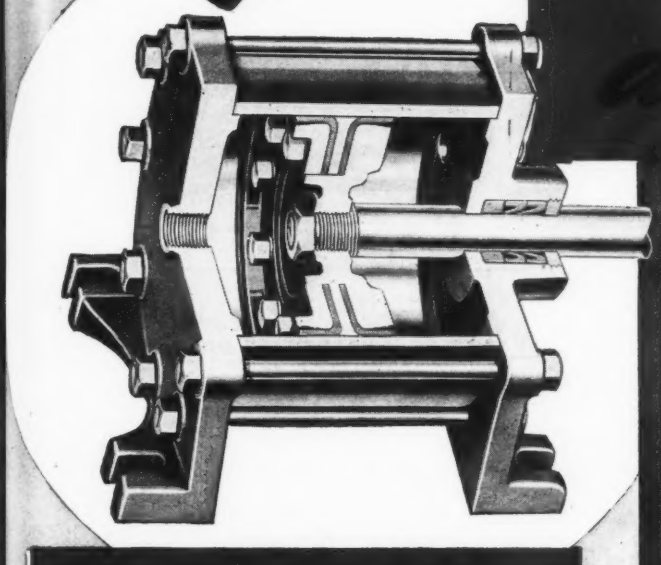
Replace Inefficient Hand and Mechanical Operations...

Get FAST-ACTING, POSITIVE, CONTROLLED POWER at Low Cost...



with Logan NON-ROTATING AIR CYLINDERS

FOR • PUSHING • PULLING • LIFTING HOLDING and OTHER APPLICATIONS

To get fast-acting, convenient power for pushing, pulling, lifting and holding operations, replace inefficient hand actuation with *standard* LOGAN Air Cylinders. Many profitable advantages can be obtained that will increase production in industrial applications of all kinds.

The constant power with follow-up assures positive, uniform actuation. Control valves may be located at any convenient point, adjacent or remote. Important savings in operator time and fatigue will result. In addition, the use of LOGAN Air Cylinders often permits simplifying the design of a mechanical structure and reducing amount of floor space required.

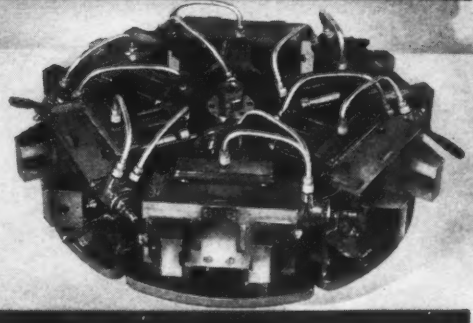
LOGAN Air Cylinders are available in 7 types of mounting to fit almost every requirement; interchangeable end covers permit a wide range of combination mountings. Manufactured in sizes from 1½" to 24" bore, with any length of stroke up to 18 feet. Recommended for operation at pressures up to 150 p.s.i.

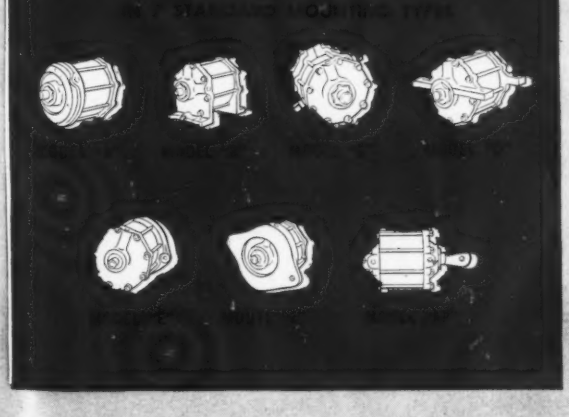
ENGINEERING ADVICE...

Write for recommendations on the proper cylinders for your applications and most effective methods of installation. No obligation.

USE COMPLETE LOGAN AIR EQUIPMENT...

For highest efficiency, use Logan equipment throughout in your complete air installations. Logan cylinders, control valves and air accessories are designed to work together as a balanced air system.





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Air and Hydraulic Equipment

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CHUCKS • CYLINDERS • VALVES • PRESSES • SURE FLOW COOLANT PUMPS

Write for complete information on LOGAN Air Cylinders, control valves and air accessories...also other items in the LOGAN line which can help you.

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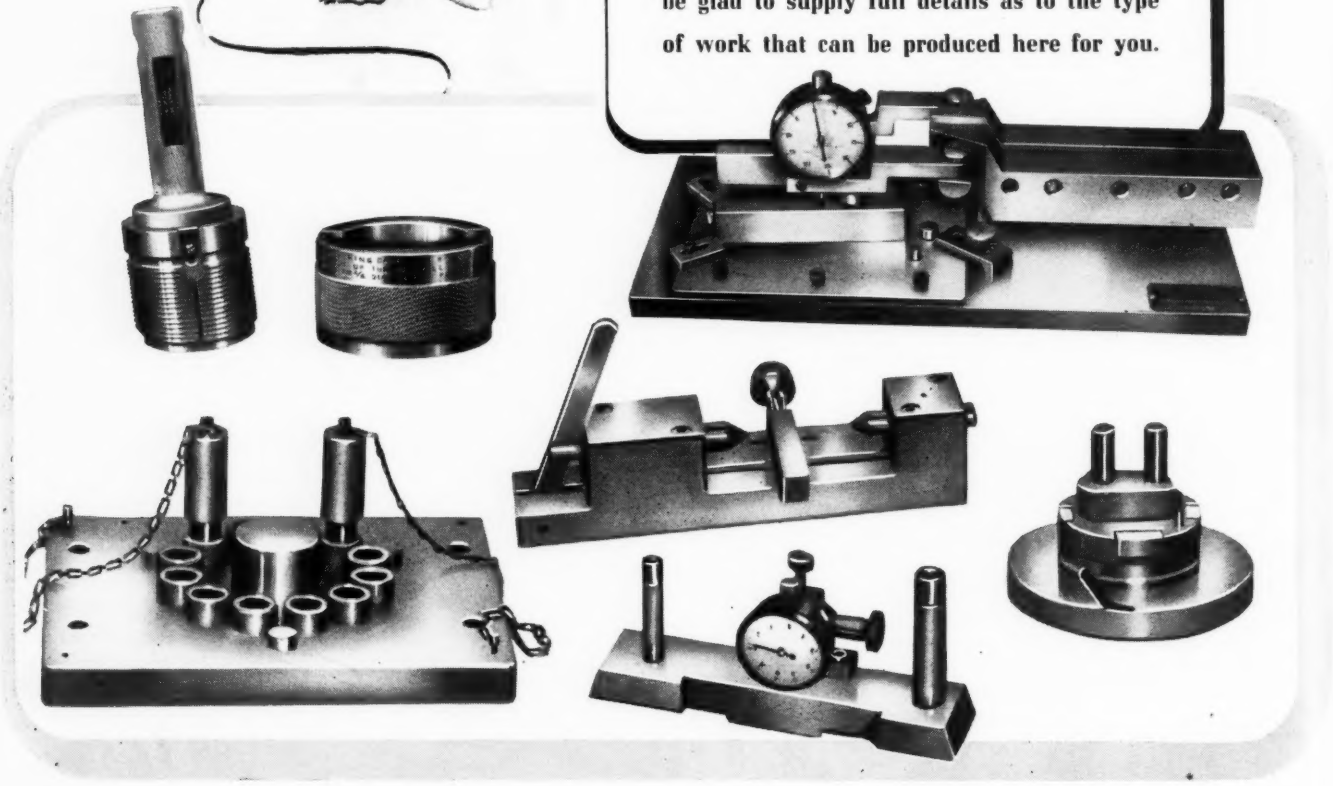
. . . *SPECIAL GAGES* or tools, fixtures and parts built to closest precision limits? Lincoln Park has a department devoted exclusively to special work. Here are combined the experience of skilled gage makers and the facilities of one of the country's finest gage plants. We'll be glad to supply full details as to the type of work that can be produced here for you.



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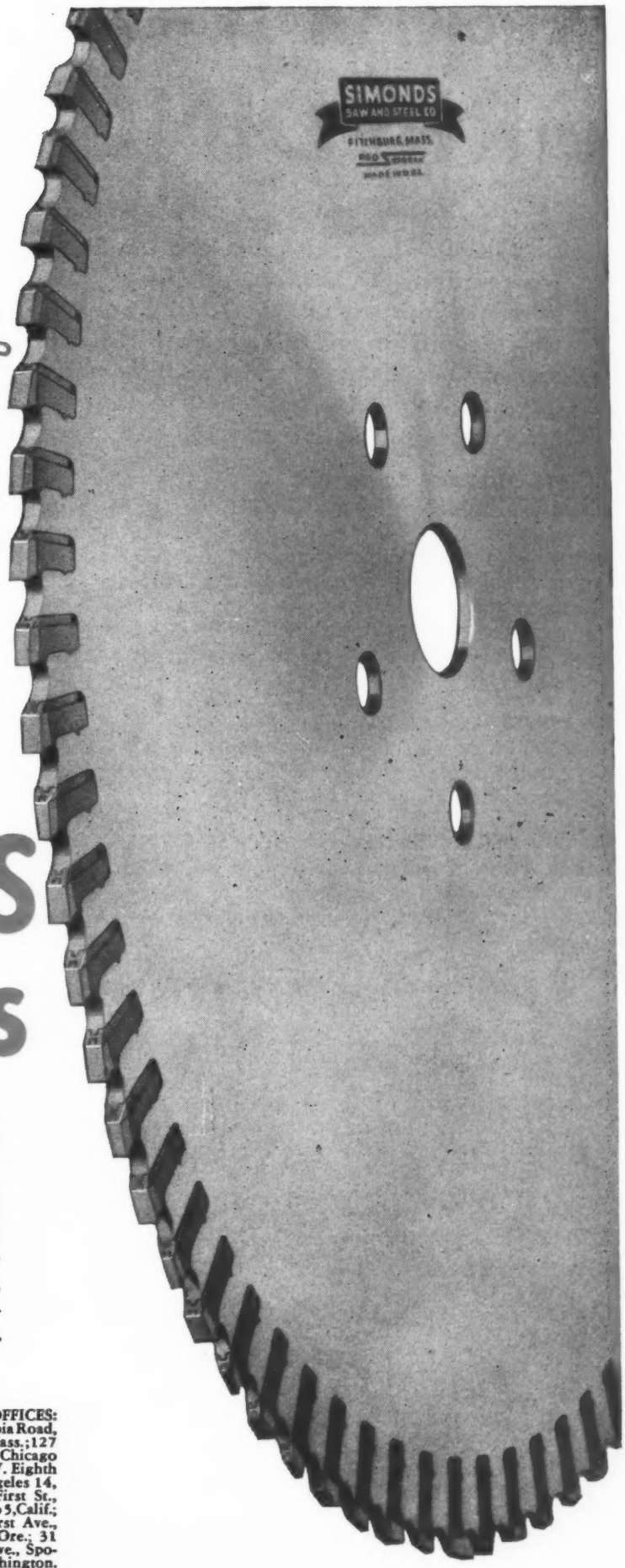

. . . the Original Saws with the CURVED-GULLET TEETH that permit Faster Speeds and Feeds . . . Deeper Cuts

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Inserted-Tooth METAL-CUTTING Saws

Curved-gullet design . . . together with alternating square and bevel teeth . . . prevents welding of chips to the saw-plate. Each tooth is held in place by its own separate wedge, which gives extra strength to the saw. And Simonds' own special high-speed steel gives greater speed, feed, and depth of cut. So for uninterrupted operation, get Simonds I. T. Metal Saws from your Industrial Supply Distributor, or from the nearest Simonds office.

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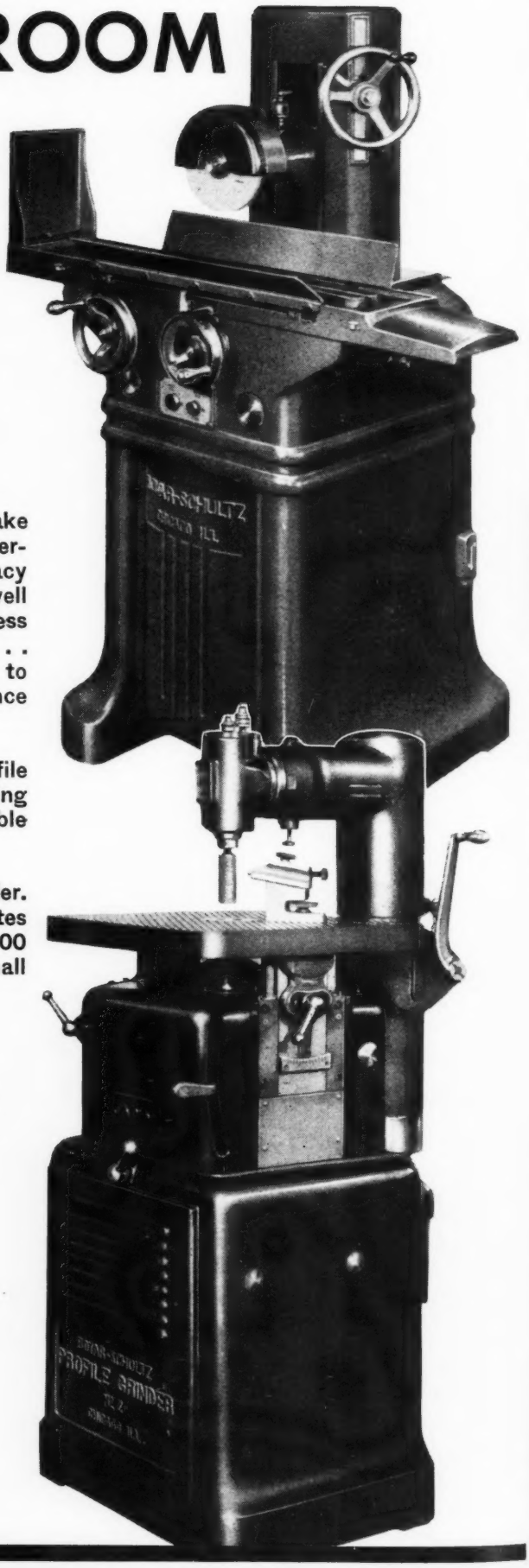
Precision TOOL ROOM GRINDING



DESIGNED for Tool Room and Die Shop where precision workmanship is all important. Built with Boyar-Schultz quality that results in sturdiness that HOLDS accuracy . . . not only in tool and die work but also in production where sustained accuracy is of special importance.

No. 618 SURFACE GRINDER — Many superior features make this Boyar-Schultz Surface Grinder an outstanding performer in producing the fine finish and extreme accuracy necessary in the finest of gage, tool and die work as well as in some production grinding. Its sturdy ruggedness maintains that fine accuracy for a long period of time . . . much longer than most similar machines are expected to last. The result of this long lasting precision performance is greater economy.

No. 2 PROFILE GRINDER — A large, floor model Profile Grinder with two independently powered spindles operating at 10,000 R.P.M. with vertical oscillations. Also available in single spindle model.

No. 1 PROFILE GRINDER — A bench size Profile Grinder. A time saver in grinding dies, punches, cams, templates or any other irregularly curved surface. Operates at 20,000 R.P.M. A rapid stock remover, even with wheels of small diameter.

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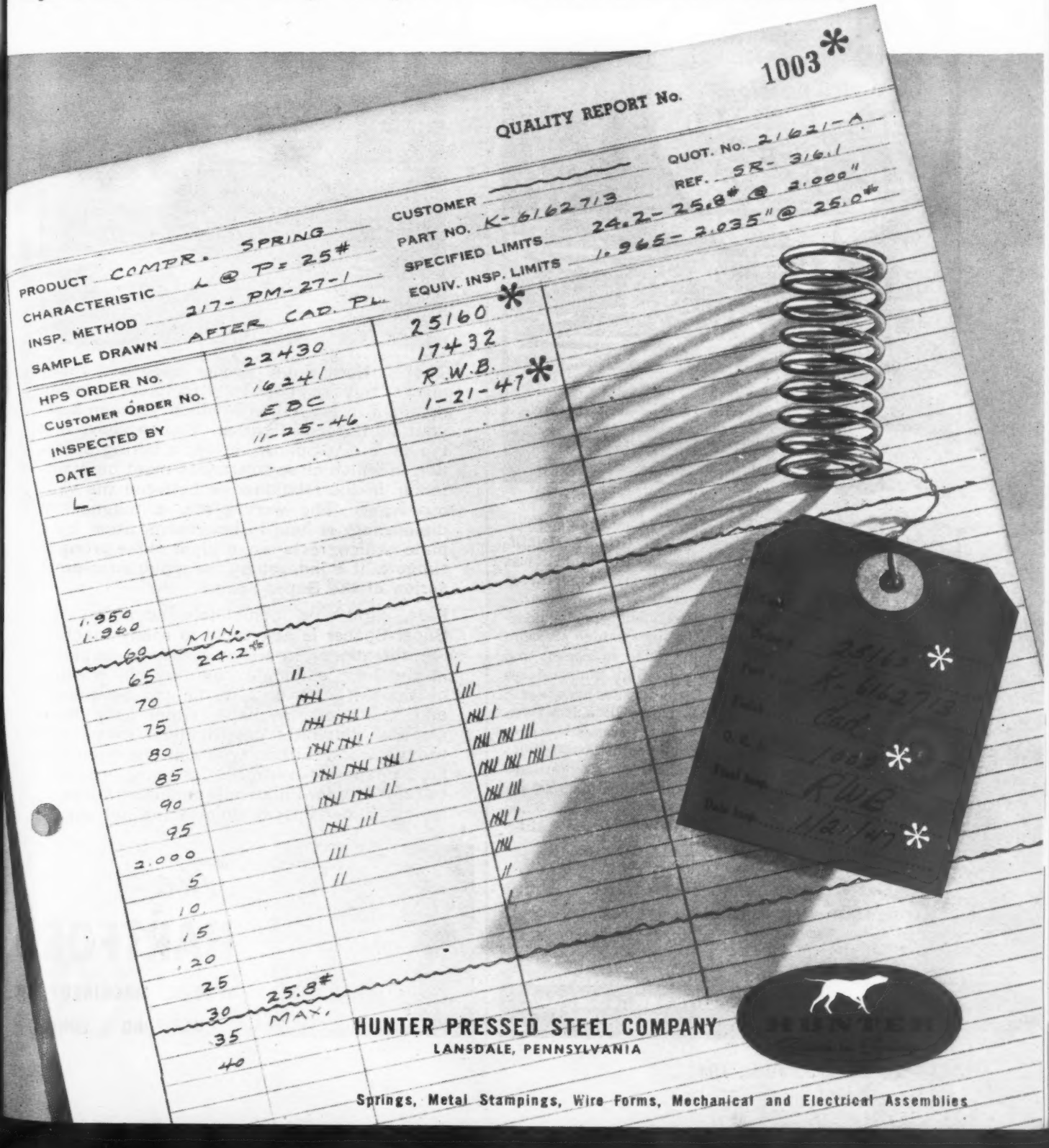
Quality Engineers have long predicted that some day suppliers would submit a record of quality to their customers and that this record would become part of a new era in vendor-customer relationships.

That day is here for Hunter customers.

Hunter now makes available to customers a report of the measured test loads for *every* lot of springs in the form of a frequency distribution. These Q.R.'s (Quality Reports) will be mailed to chief engineer, inspector or other person designated. The Q.R. of the sample drawn from *each* lot of *every* item will be sent as the lot clears Hunter's final inspection.

These reports enable one to compare quality lot-for-lot, consider tolerance revisions, reduce customers' sampling without sacrificing quality insurance . . . will lead eventually to a comparison of quality vendor-for-vendor.

Hunter believes it is the first in industry to make this valuable service available to all customers.



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Springs, Metal Stampings, Wire Forms, Mechanical and Electrical Assemblies

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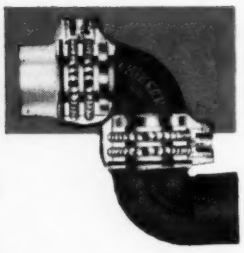
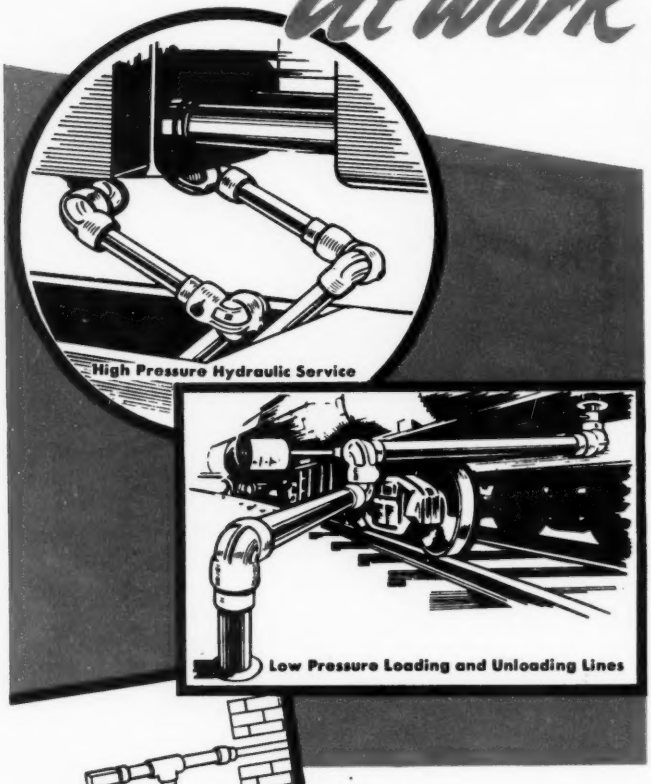


BALL BEARING SWIVEL JOINTS

At work



Look around you and you will see CHIKSAN *Ball-Bearing* Swivel Joints at work in many different applications...from low pressure loading and unloading lines to high pressure hydraulic equipment and under high temperatures on boilers and open hearth furnaces. CHIKSAN Swivel Joints are made in over 500 different Types, Styles and Sizes... for pressures from 300 psi to 12,000 psi and temperatures to 500° F....for full 360° rotation in 1, 2 and 3 planes...with threaded or flanged ends or bored for welding.

Write for CHIKSAN CATALOG No. 45.

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Branches: New York 7, Houston 2

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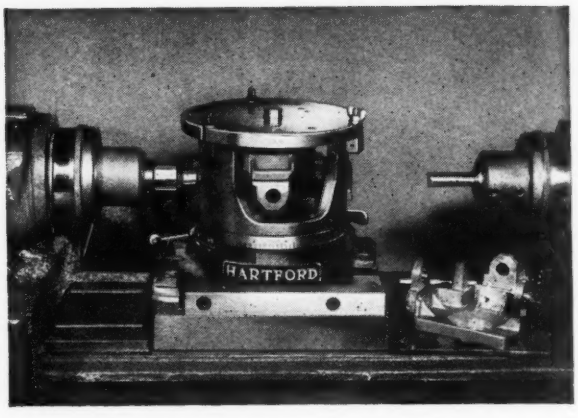
CHIKSAN COMPANY
BREA, CALIFORNIA
New York 7 Houston 2

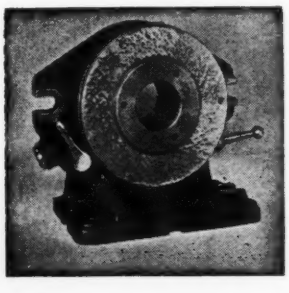
The

SUPER-SPACER SPEEDS PRECISION INDEXING JOBS!



The Hartford Super-Spacer Base is a ready answer to your needs for a foolproof indexing mechanism around with which you can build your own special fixtures. Shown above is a typical Super-Spacer set-up, a boring operation in which close tolerances must be maintained in the relationships between the various holes. The work piece, a magnesium die-casting, is held in inverted position by a plate which rests on a rigid three-pronged support. It is indexed by the rapid, error-proof action of the Super-Spacer.

Fast, rigid and completely accurate, the Super-Spacer is adaptable to many machining operations. Interchangeable mask plates in the base eliminate counting-off, making divisions of 2, 3, 4, 6, 8, 12 and 24 quickly and accurately. Available either as a Base alone, as illustrated or with chuck for general run of work. Either type can be mounted horizontally or vertically on any machine table. Write for full details and illustrations of typical Super-Spacer time-saving set-ups.



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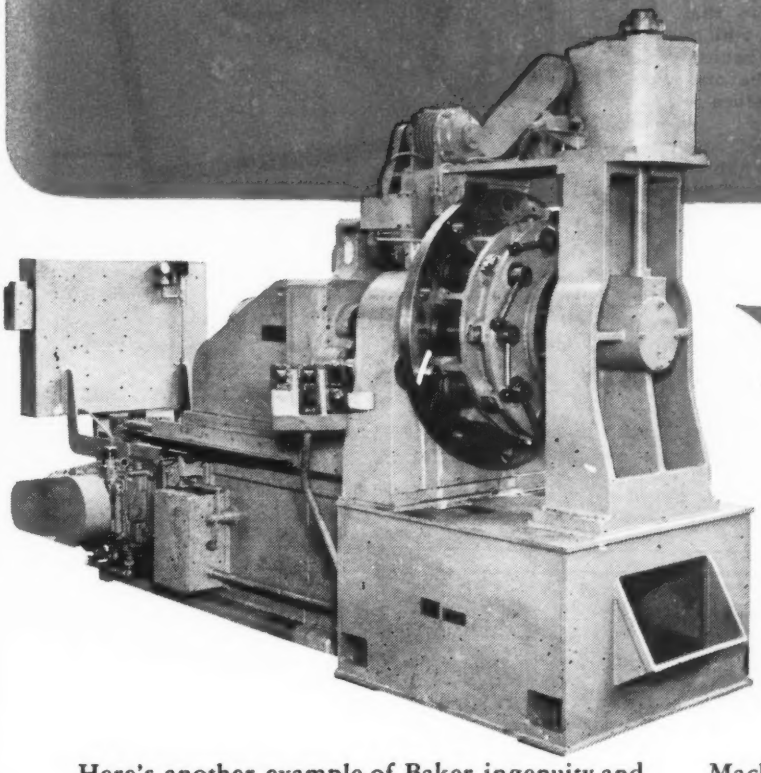
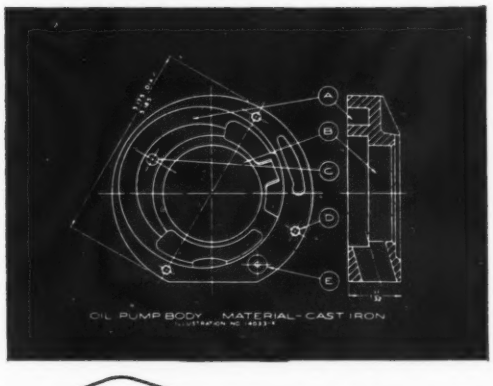


★One Way Machine

HANDLES MULTI-OPERATIONS AT ONE CHUCKING

Here's another example of Baker ingenuity and know-how simplifying production—making possible increased output per man and per machine!

This Baker Machine is a Model 3½ x 24 Floor Type Hydraulic Feed Unit built into a one-way Multi-Spindle with rotary index trunnion fixture. The part handled is an oil pump body.



Machine is designed to perform all operations at one chucking, part not leaving fixture until all operations at each station are performed. Saddle carrying accurate multi-spindle head mounted on bars. Automatic power index to trunnion fixture. Consult with Baker concerning your productivity-problems.

NOTE ECCENTRIC PATH MACHINING

Here is the sequence of operations on the oil pump body shown at left at the ten stations of the machine:

Station No.	Operation
1	Load and unload the part.
2	Rough out Eccentric Pathway "A".
3	Semi Finish Eccentric Pathway "A".
4	Rough Bore and Rough Counterbore "B".
5	Semi Finish Bore and Semi Finish Counterbore "B".
6	Spot Drill .500" diameter one hole "E". Chamfer 5/16" diameter three holes "D".
7	Drill 15/32" diameter one hole "E".
8	Drill .2656 diameter one hole "C". Drill ⅛" diameter one hole "E". Drill .2631 diameter three holes "D".
9	Ream .500" diameter one hole "E". Tap ¼"-20NC with Lead Screw Tapper three holes "D".

See us at MACHINE TOOL SHOW Chicago—Sept. 17-26 BOOTH 639 & 681

BAKER BROTHERS, Inc. TOLEDO OHIO

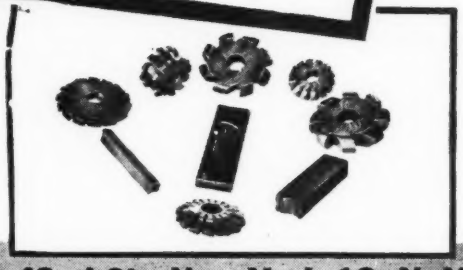
DRILLING...TAPPING...KEYSEATING...CONTOUR GRINDING MACHINES

M.R.E.
RADIUS ATTACHMENT

The M.R.E. Radius Attachment operates on an entirely new principle that does away with the necessity of setting the workpiece or diamond to a given distance from a central pivot. No part of the fixture moves more than the desired amount as measured on the Vernier Scale, which gives it a distinct advantage over other types of radius attachments which describe a circle greater than the one required and often foul the head of the machine before a complete half-circle is produced on the workpiece.

Convex and concave work of various radii up to 1½" can be produced with one width of wheel by adjusting the table. The M.R.E. Radius Attachment can be used on lathes, surface grinders, cylindrical grinders, vertical and horizontal milling machines, etc. It can be used as an indexing attachment for jig boring by using an index plate supplied by the makers.

Equipment includes universal head, diamond holder and indexing finger. Centers and blocks can be supplied if required. The attachment is 9½" long × 14" × 5" high. Weight with universal head and diamond holder, 52 pounds. Write today for complete information. Address Dept. M-6.



A few of the components which can be processed by the M. R. E. Radius Attachment. ☞

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Sole U. S. Agent

Mfd. by *Manchester Repetition Engineers, Ltd., Manchester, England*

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SWIFT FLOOR comes to you ready for use. Simply prime the surface, tamp or roll, and let the traffic roll. It's just that easy.

SWIFT FLOOR users comprise the "Blue Book" of American Industry. Join them.

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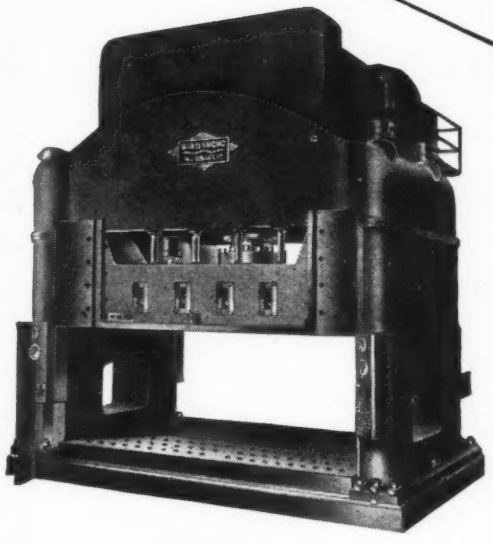
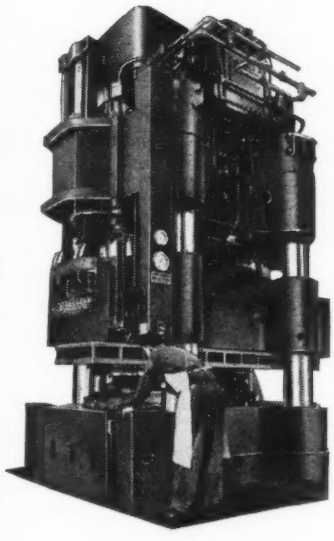
Street and No. .....

City.....State.....

BIRDSBORO
HYDRAULIC

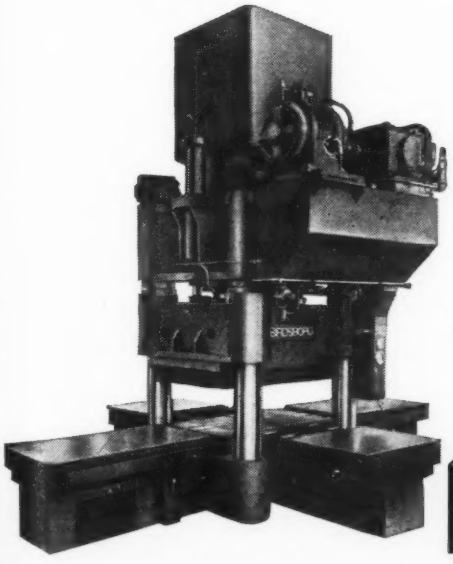


HYDRAULIC PRESSES
Engineered by BIRDSBORO
PROVIDE DEPENDABLE LOW-COST PRODUCTION



● Birdsboro's engineers have had broad experience in designing and building hydraulic presses for every type of metal working operation involving the use of pressure.

The accompanying list indicates some of the many operations being performed by Birdsboro Hydraulic Presses. If your production calls for the use of presses, Birdsboro engineers will be glad to work with you in designing and building just the type and size of press best suited to give you dependable, low-cost production.



Stamping
Forming
Forming by Guerin process (rubber pad)
Drawing (Single, double and triple action)
Coining
Bulging (expanding hydraulically)
Dishing
Crimping
Bending and straightening (of structural shapes, plates, weldments, steel castings, etc.)
Flanging
Joggling
Piercing
Shell forging and drawing
Pipe bending
Riveting
Scrap crushing
Lead extrusion (cable covering)

BUILDERS OF: Hydraulic Presses - Steel Mill Equipment - Rolls - Special Machinery - Crushing Machinery

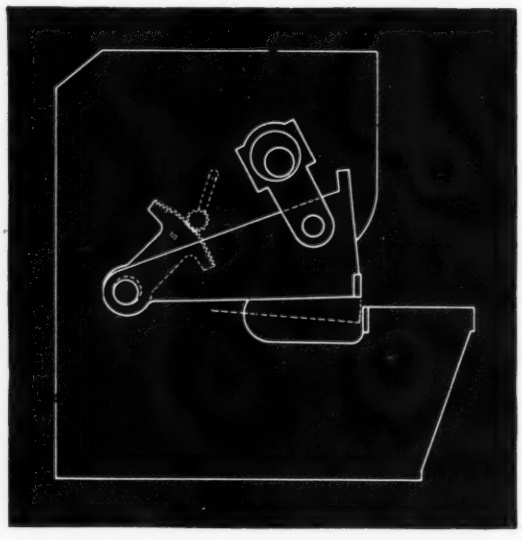
Birdsboro Steel Foundry & Machine Co. • Birdsboro, Pa.

BIRDSBORO
HYDRAULIC PRESSES

NO OTHER SHEARS ARE LIKE STEELWELD!

RADICALLY DIFFERENT WITH REVOLUTIONARY FEATURE

Users from coast to coast are acclaiming the merits of Steelweld Shears. These power-driven metal-cutting machines are different from all other shears on the market. They represent the greatest advancement in shear design in decades.



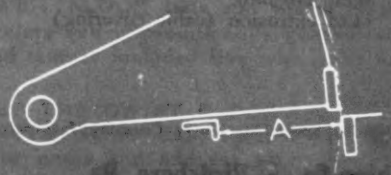
A revolutionary pivoted-blade principle is employed that makes possible several outstanding advantages and overcomes certain handicaps of present-day guillotine type shears. There are no slides and guides to wear out of true and cause inaccuracies. The upper blade operates on two heavy pivot pins secured to the end housings and travels in a circular path.

The knife clearance is easily adjusted to suit the plate thickness by turning a convenient hand crank. A large dial indicator shows the thickness that may be cut for any knife setting.

A complete line of Steelweld Shears has been developed for cutting plate of all thicknesses from 12 gauge to 1¼ inch and for lengths of 6 feet to 18 feet. They may be arranged for squaring, slitting and notching. Speeds range from 60 strokes per minute on the smaller sizes to 25 strokes per minute on the largest shear.

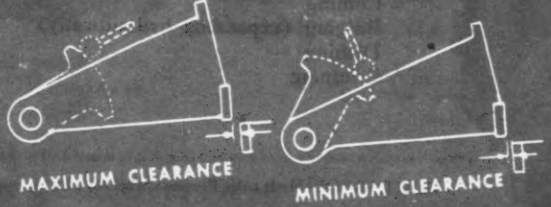
3 Outstanding Features

1 UPPER KNIFE TRAVELS IN CIRCULAR PATH



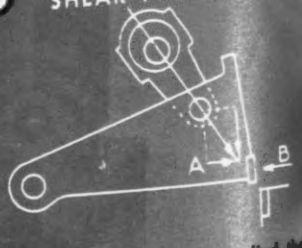
Blade turns on pivot pins. No guides and slides, as in guillotine-type shears, to wear and cause inaccuracies. Upper knife swings away from lower one, increasing distance "A" from back gauge to stationary knife, thereby permitting sheared pieces to drop freely without binding.

2 FAST KNIFE ADJUSTMENT



Knife clearance easily and quickly made to suit every plate thickness. No bolts to loosen; no parts to move. It is only a matter of turning a crank and watching the indicator which indicates the clearance in thousands of an inch and also shows the plate thickness that may be cut for any knife setting.

3 COUNTERACTING SHEAR PRESSURE

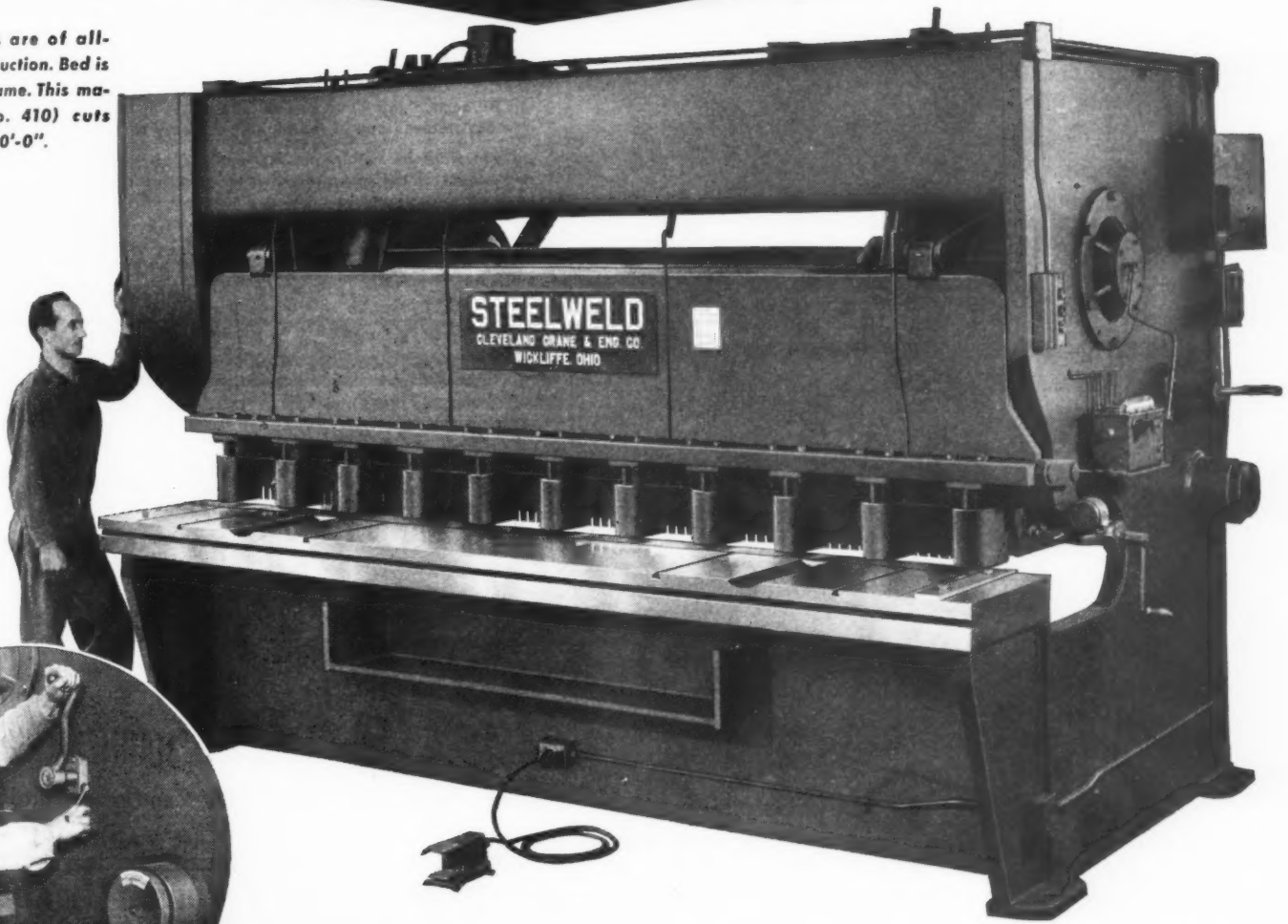


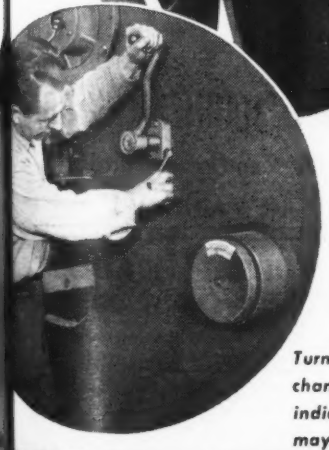
The shearing force is so applied that its horizontal component "A" will approximately equal and counteract pressure "B" that develops in the knives during shearing, tending to spring them apart. This reduces the load on the blade pivot pins to a negligible amount and assures long, trouble-free life at these points.

IMPORTANT ADVANTAGES

1. Knife clearance easily adjusted to suit plate thickness.
2. Smooth, clean cuts.
3. Accurate, straight and true edges.
4. Easy and simple to operate.
5. Fast cutting and high production.
6. Convenient electric foot control.
7. No slides or guides to wear.
8. Trouble-free mechanical hold-downs.
9. Easily arranged for squaring, slitting or notching.
10. Convenient back gauge.
11. Negligible twist, camber and bow in cut pieces.
12. Quiet operating.
13. Designed for safety throughout.
14. Long knife wear between grindings.
15. Knives easily removed or replaced.
16. All-welded one-piece frame with bed integral.

ld Shears are of all-steel construction. Bed is part of frame. This ma-Model No. 410) cuts to ¼" x 10'-0".





Turning this convenient crank changes the knife clearance. The indicator shows plate thickness that may be cut for any knife setting.

Electric foot switch operation is a standard feature on all Steelweld Shears. Easily operated by toe action, the switch can be slid around the floor to wherever most convenient.

ET THIS BOOK!

STEELWELD PIVOTED BLADE SHEARS

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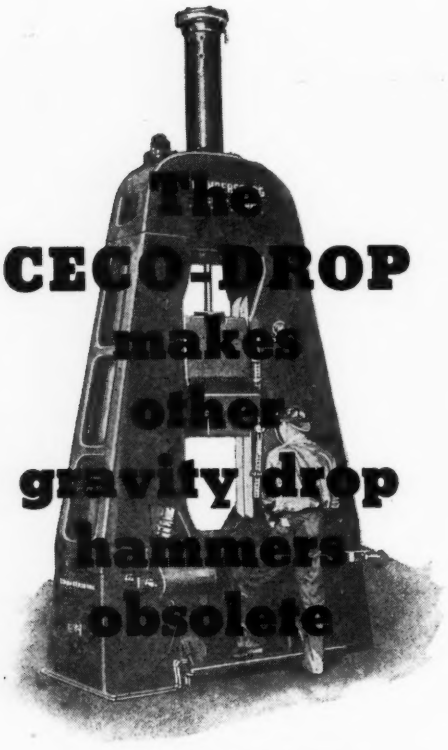

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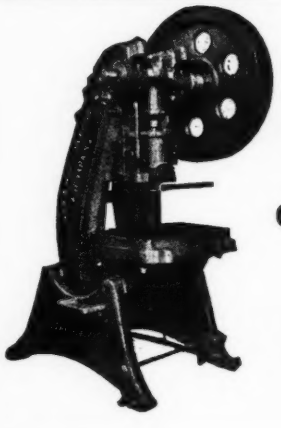

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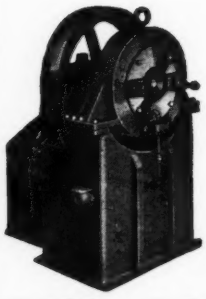

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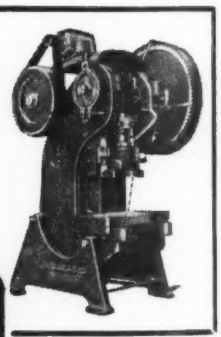

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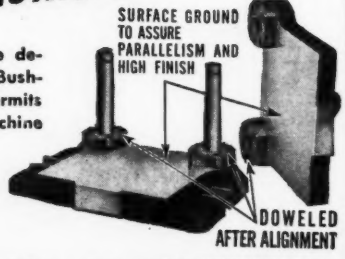

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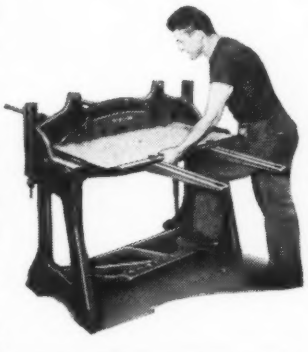

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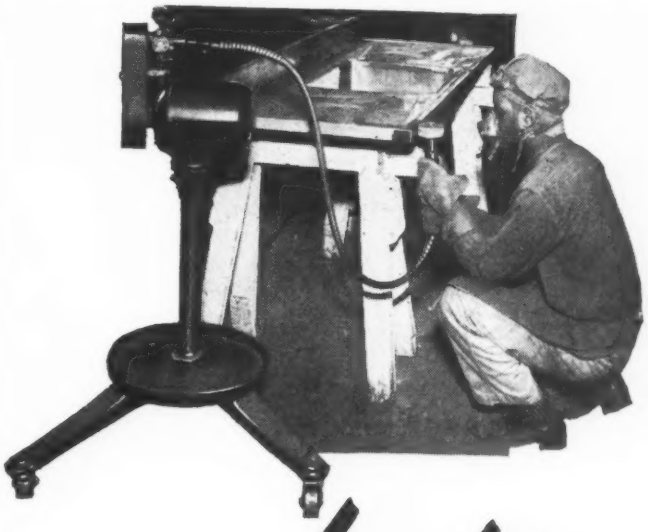

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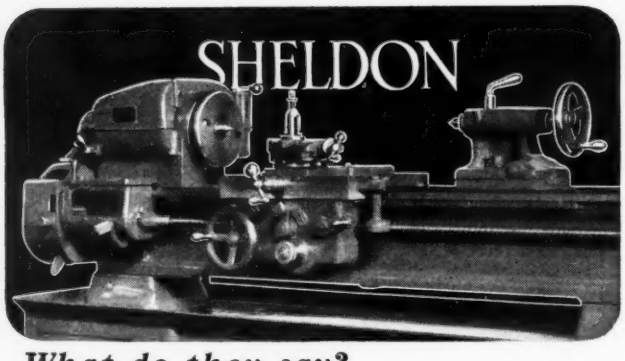

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"Large hole in spindle"—There's a 1⅜" hole thru the spindle.

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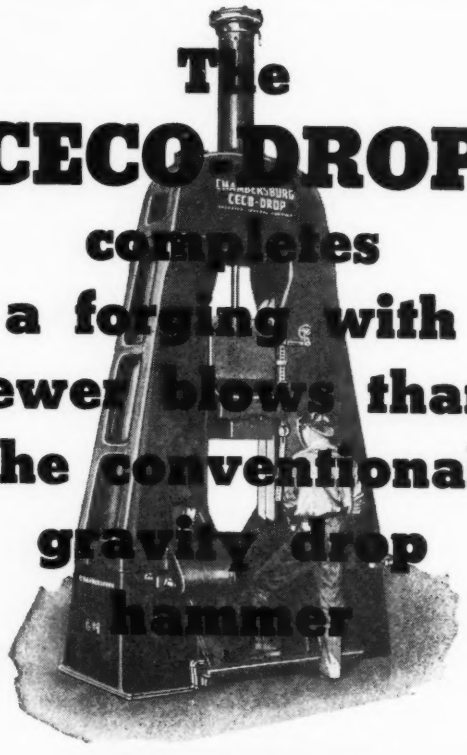

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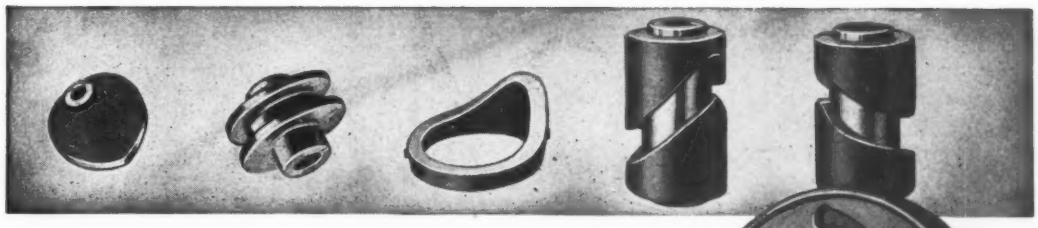
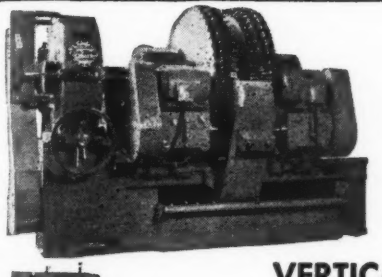
CHAMBERSBURG ENGINEERING CO. • CHAMBERSBURG, PA.



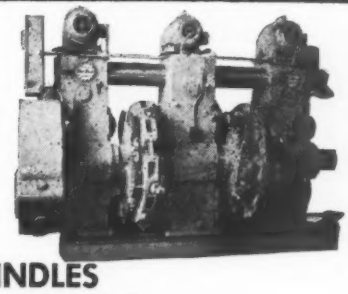
Cam Specialists — plus specially designed equipment! That's the reason why Rowbottom is known as cam-making—and cost-cutting headquarters. Whenever you need cams, in any size, type, or quantity, you can be sure that Rowbottom-made cams will be right in design and in price.

THE ROWBOTTOM MACHINE CO.
WATERBURY, CONN., U. S. A.

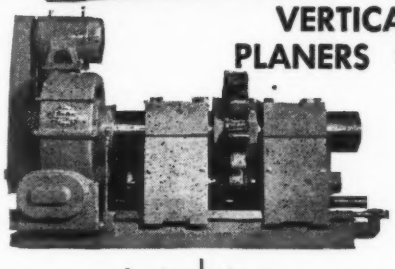
Rowbottom for Cams



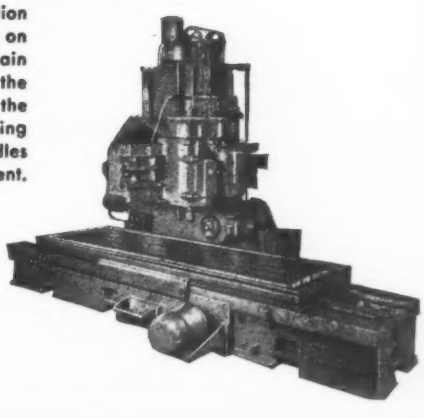
Roto-Matic MILLERS

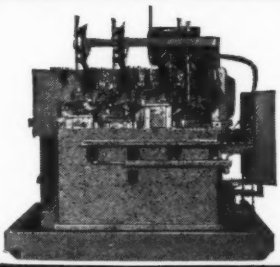


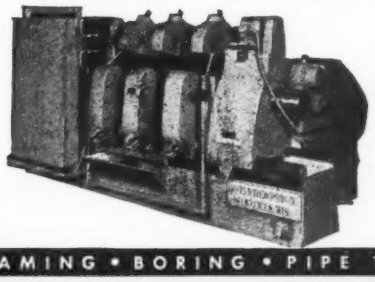
ROTARY DRUM TYPES •
VERTICALS • SINGLE AND MULTIPLE SPINDLES
PLANERS • RISE AND FALL • VERTICAL INDEXING



The ROTO-MATIC principle of continuous production insures the maximum of production and accuracy on any job to which a Miller has been adapted. Chain clamping mechanisms, where adapted, leave the operator free to load and unload parts. On the larger type Rotary Drum Type Millers finishing spindles are adjustable for toe cut. All spindles have provisions for micrometric endwise adjustment.





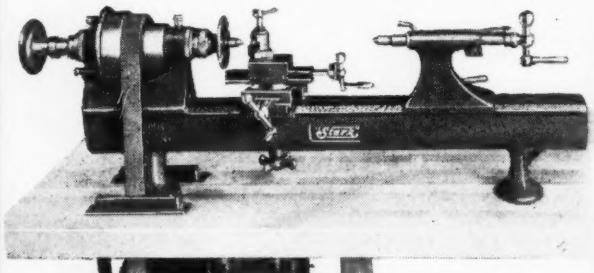


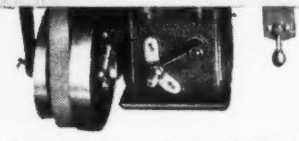
MILLING • DRILLING • REAMING • BORING • PIPE THREADING • SPECIAL MACHINES

DAVIS & THOMPSON COMPANY
MANUFACTURERS: MACHINE TOOLS, MICROMETERS AND GAGES
MILWAUKEE WISCONSIN

Built-in infinitely adjustable drive with any speed at the turn of a convenient handwheel in front. No special bench or cabinet required. 156 to 2200 r.p.m. with Standard (toolroom) model and 220 to 3500 with High Speed (Manufacturing) model. Smooth brake and clutch. Capacity, ¾" or 1" through headstock; 9" swing, 40" length bed.

30 PRECISION ATTACHMENTS correctly designed for the very best facility and accuracy are interchangeable with all Starks of the same lathe size

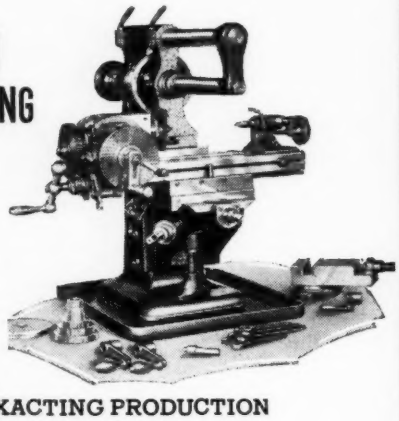




OPEN CONE LATHES

Built in four good sizes, ¼" x 5⅞" swing, ½" x 7", ¾" x 9" and 1" x 9" with Stark Motor Drive Unit, the first compact, smooth under-bench drive, with 9 speeds—the full working range.

PRECISION BENCH MILLING MACHINES



Plain and spiral Models, motor-driven. Table 18" x 4", feed 10", transverse 3½", vertical over vise 4¾".

FOR EXACTING PRODUCTION it is fitted with fast lever feeds

Also "ELECTROBLAST" Muffle Furnaces

Gas fired. High speed steel temperatures in 20 minutes. Built in two small sizes.

FOR FURTHER INFORMATION, WRITE US.

Stark Tool Company

WALTHAM · MASSACHUSETTS

ESTABLISHED · 1862

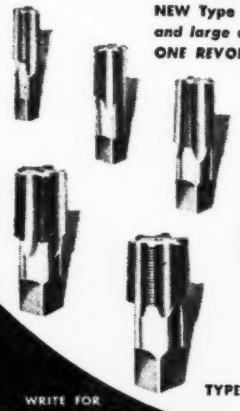
Originators of the American Bench Lathe

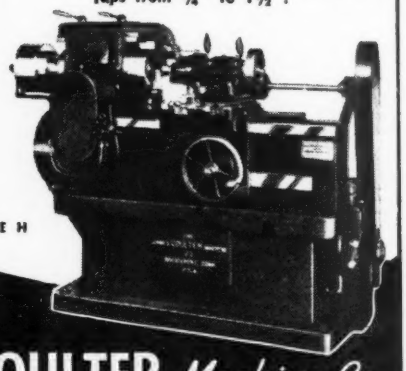
. . . A "REVOLUTION" IN MACHINING INDUSTRY . . .

TOUGH Threading jobs licked by COULTER TYPE "H" THREAD TAP MILLING MACHINE

NOW . . . comes a development that extends the capacity of this 'wonder' machine. COULTERS' are made to perform the most delicate threading operation with both speed and accuracy . . . 40 years of specialized experience, manufacturing precision machines exclusively. The NEW Type "H" is equipped with *an overarm tail center and large collet chuck*, holding the work rigidly so ONLY *ONE REVOLUTION OF THE TAP* is necessary.

Any number of FLUTES, eccentric or con-eccentric relief straight or taper can be produced. Pipe taps from ⅛" to 1½" and straight taps from ¼" to 1½".





TYPE H

WRITE FOR FULL PARTICULARS

PRODUCTION MACHINES SINCE 1896

The James COULTER Machine Co.

BRIDGEPORT • CONNECTICUT • U.S.A.

MILLING—BURKE—MACHINES

No. 0000 MILLING MACHINE

NEW!

LOW COST, KNEE TYPE MILLING MACHINE . . . .

designed for small, accurate work

Write for Literature . . . TODAY!

GENERAL SPECIFICATIONS

Longitudinal Feed	6"
Traverse Feed	1½"
Vertical Feed	4"
Floor Space	21 x 14½"

Tapered Gibs
No. 5 B. & S. Spindle Taper
All rotating parts moving in anti-friction bearings.
All sliding members moving in scraped dove-tailed ways.

MANUFACTURERS OF PRECISION KNEE TYPE MILLING MACHINES AND PRODUCTION ATTACHMENTS

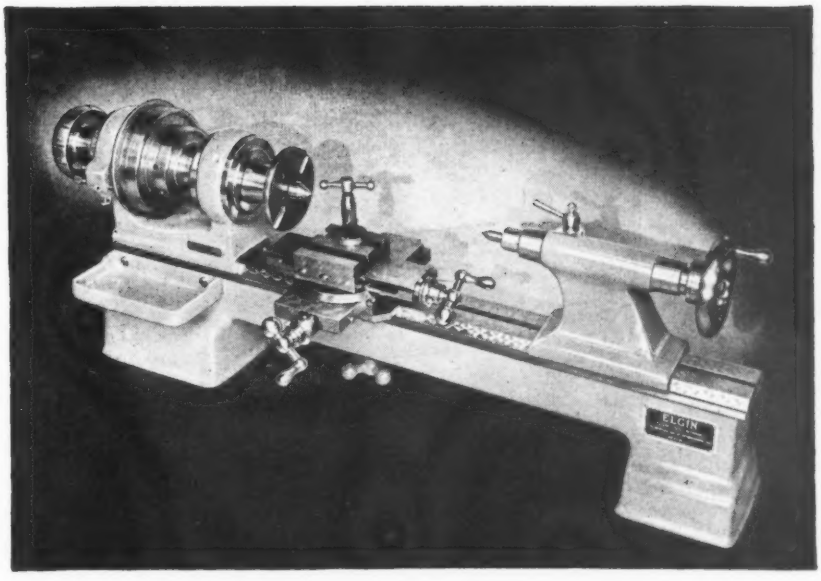
BURKE MACHINE TOOL CO.

520 SANDUSKY STREET

CONNEAUT, OHIO

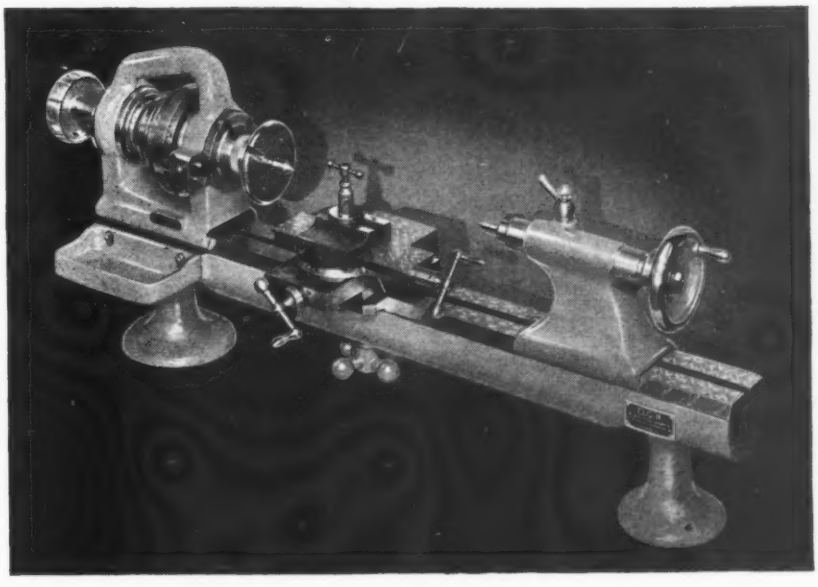
Whether you choose the CB-5C . . .

Open Cone Headstock, 9" swing, 17" between centers, 36" bed. 1" collet capacity. Speeds up to 4000 RPM. Flat belt only.



--Or prefer the 4EV . . .

Open Cone V-Belt Headstock, available for either V or flat belt operation. 7" swing, 17" between centers, 32" bed. 7/16" collet capacity. Speeds up to 10,000 RPM.

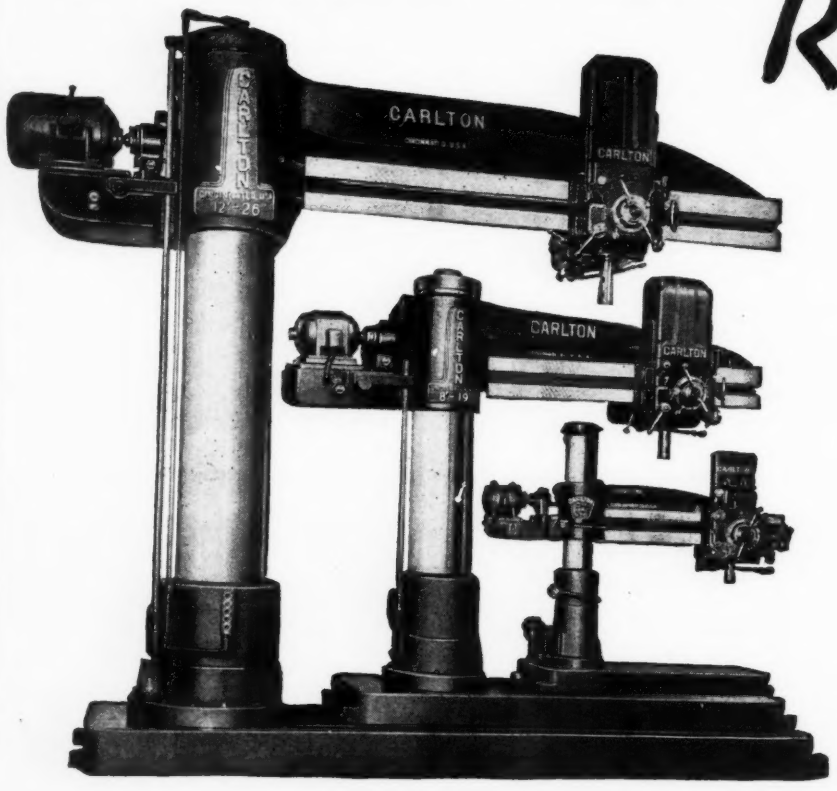


--You'll get your Small-Diameter Work done better, faster on

Fast operation, sustained accuracy are assured with ELGIN Precision Bench Lathes. Both models illustrated here feature extra-heavy spindle and base construction for positive rigidity . . . precision preloaded ball bearings that insure true running at all speeds and under all conditions . . . greater sensitivity and higher precision than ever before. Other Bench Lathes available mounted on steel cabinets with ample drawers and shelf space. Also, Precision Hand Screw Machines, Precision Bench Millers. Write for data. ELGIN TOOL WORKS, 1770 Berteau Avenue, Chicago 13, Ill.

ELGIN PRECISION BENCH LATHES

CARLTON *Radials*



The Carlton Machine Tool Co. offers a complete line of Radial Drilling Machines exclusively, in sizes ranging from 3′ arm to 12′ arm, and from 9″ dia. column to 26″ dia. column. Carlton Radials are delivering outstanding service in almost every large manufacturing plant in the country, as well as railroad shops, shipyards, steel mills, etc. Carlton all-ball-bearing construction with original low-hung drive to spindle makes operation—even under heavy loads—smooth, vibrationless and chatter-proof. Many other modern features available. For greater production, greater economy and satisfaction... investigate Carlton Radials today!

THE CARLTON MACHINE TOOL CO.
CINCINNATI, OHIO.

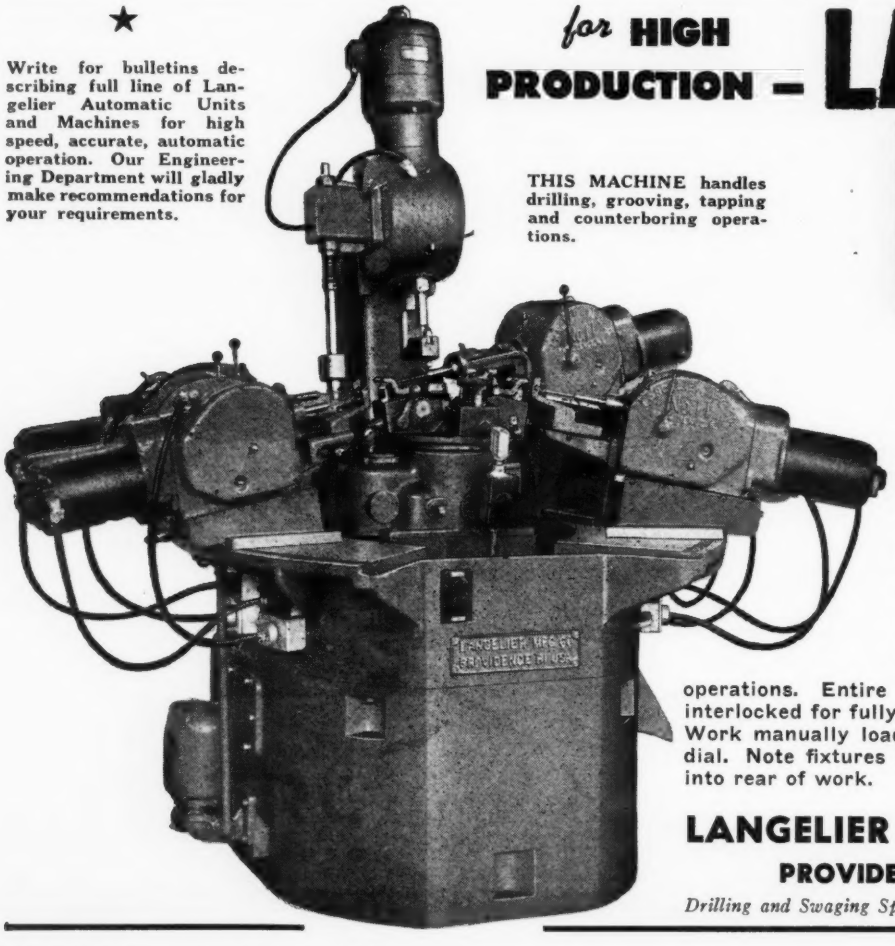
★

Write for bulletins describing full line of Langelier Automatic Units and Machines for high speed, accurate, automatic operation. Our Engineering Department will gladly make recommendations for your requirements.

for **HIGH PRODUCTION —**

LANGELIER

AUTOMATIC UNITS *for* MULTIPLE DRILLING TAPPING ETC.



THIS MACHINE handles drilling, grooving, tapping and counterboring operations.

Speed and efficiency are contributed to multi-operation production by LANGELIER Automatic Units arranged in various combinations. Typical is the Special Machine at left, which handles drilling, grooving, tapping and counterboring operations by means of five Langelier Drilling Units and one Tapping Unit. (Also available: milling, reaming, spotting, chamfering, etc.) Multiple Spindle attachable Langelier heads may be mounted on feed sleeves of each Unit for combinations of these operations. Entire machine, as illustrated, is electrically interlocked for fully automatic operation and central control. Work manually loaded and clamped in fixtures on 4-station dial. Note fixtures mounted at 10° angle to permit drilling into rear of work.

LANGELIER MANUFACTURING CO.
PROVIDENCE • RHODE ISLAND
Drilling and Swaging Specialists for Over 50 Years... Incorporated 1887

RIVETT

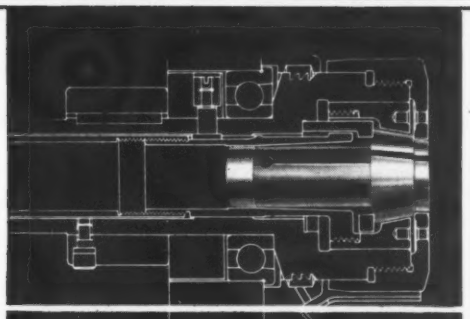
WHEN COSTS AND QUALITY COUNT THE *New* 918S TURRET LATHE

If you machine small and medium sized parts from bar stock or on second operations – look to this new Rivett Turret Lathe. It is designed to buy its way into your plant with cost savings and quality control.

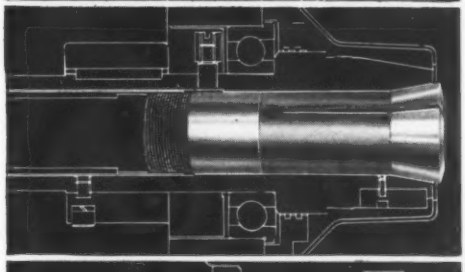
The 918S Turret Lathe cuts the initial cost of investment by taking work from larger machines. It follows by reducing the "dead time" of set-up and spoilage on every job. Then it really pays with lowered time on every piece. How? – With the right spindle speed for efficient tooling, with quick means for chucking work, with properly grouped control levers and by reducing operator fatigue.

Features designed into the 918S Turret Lathe to guard quality include a rigidly mounted precision ball bearing spindle, precise tool indexing, hardened and ground steel bedways, vibration-free drive and mounting.

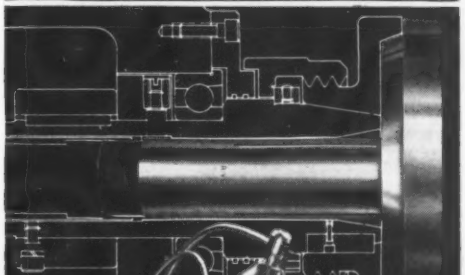
Write for Bulletin 918-ST



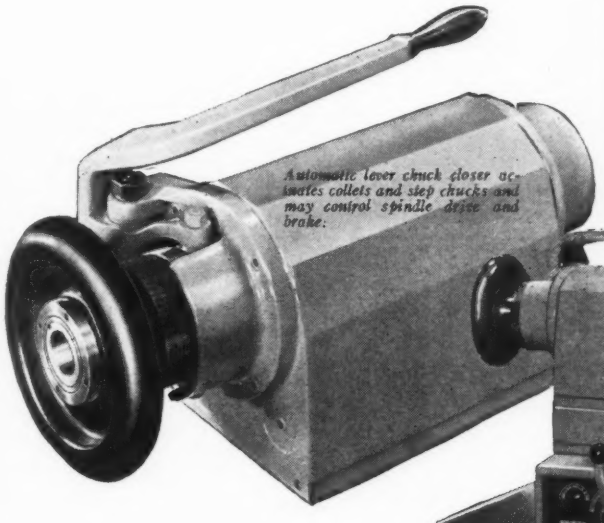
Stationary Collet – closes without lateral movement to maintain perfect lengths on bar stock. Maximum capacity 7/8" round.



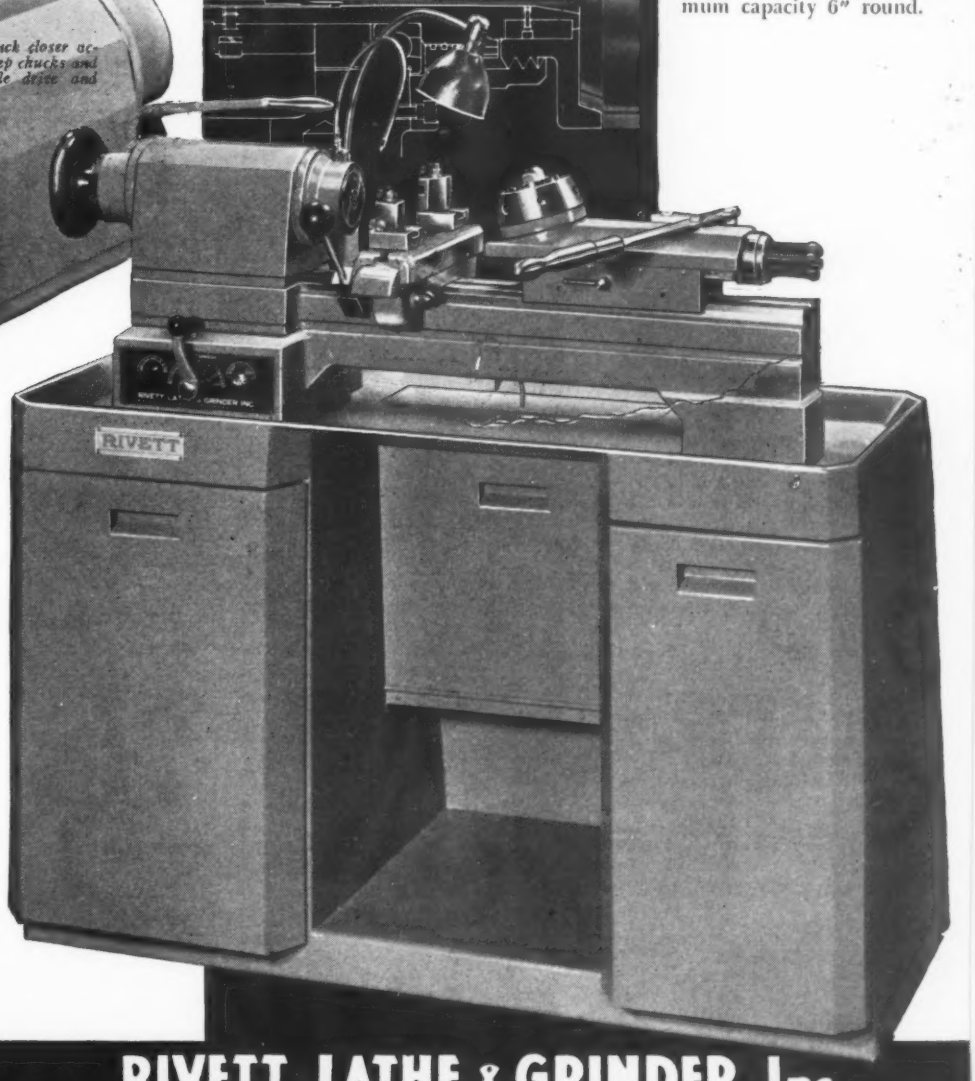
Draw-In Collet – new design holds work truer with greater gripping power. Maximum capacity 1 1/8" round.



Step Chuck – for accurate chucking of circular or irregular parts requiring only a short grip. Maximum capacity 6" round.



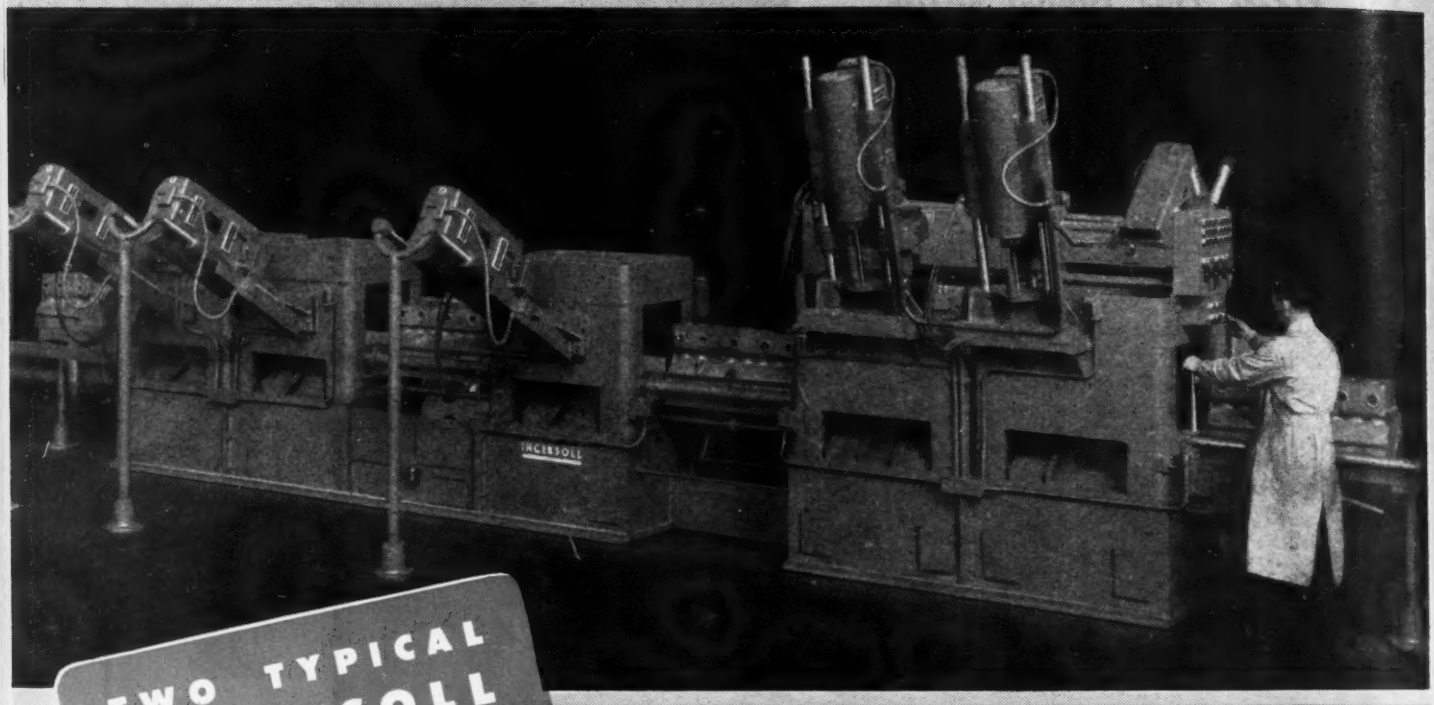
Automatic lever chuck closer actuates collets and step chucks and may control spindle drive and brake.



RIVETT LATHE & GRINDER, Inc.

BRIGHTON · BOSTON · MASS. · U. S. A.

THE NAME INGE



TWO TYPICAL INGERSOLL MACHINES

(Above)

Sixty three automobile motor blocks an hour are processed by this Ingersoll 8-Station Drilling, Reaming, Chamfering and Tapping Machine. The fixture automatically clamps and transfers the work from station to station. The operator positions the casting and starts the machine. Nine Ingersoll Power Packs quick approach, perform their various operations and rapid return to complete the machining cycle.

(Right)

A thirty horsepower Ingersoll Adjustable Rail Milling Machine rough and finish milling rails for two Type "A" Ingersoll Adjustable Rail Machines. Ingersoll carbide tipped inserted tooth cutters are being fed at 24" a minute. The operator controls the machine with his fingertips by means of push buttons on the pendant.

THE INGERSOLL MILLING

RSOLL MEANS

1 Special design that integrates the machine, the work holding devices and the cutters into one productive unit.

2 Guaranteed accuracy and production that is demonstrated in our customer's plant.

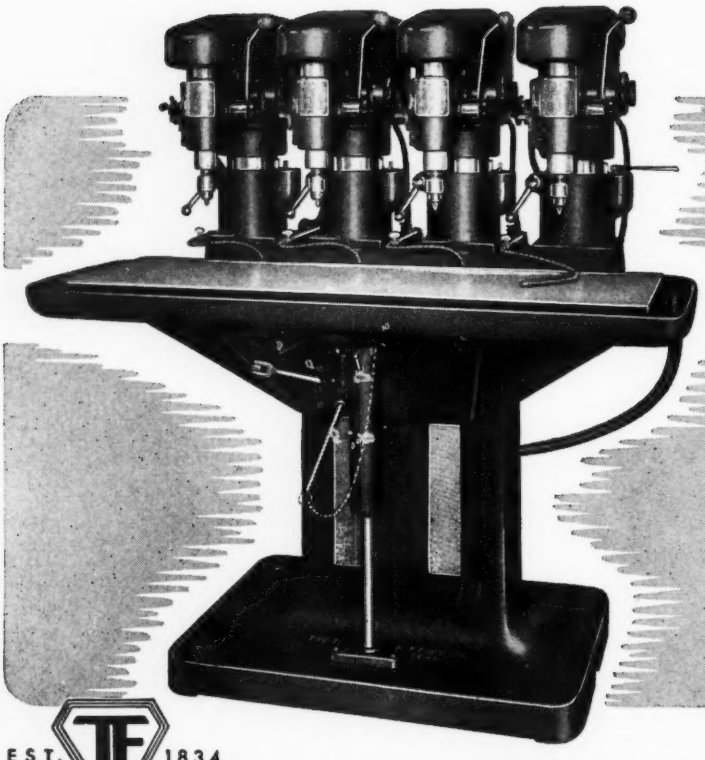
3 Sixty years experience in designing special machine tools for a great variety of industries.

4 An organization which has solved a great number of difficult and complex production problems.

MACHINE CO., ROCKFORD, ILLINOIS

A HUNDRED *and* ONE SPEEDS

INSTANTLY AVAILABLE
WHILE MACHINE IS RUNNING



- The exact speed required for drill diameter and material at the turn of a knob.
- Exact control of speeds means less breakage, fewer grinds, higher efficiency.
- Reference speed chart on front of head.
- Spindle: sealed precision ball bearing... no lubrication required.

TWO MODELS — 1 to 6 Spindles
M-125 — 3/8 Cap. (Illustrated)
M-96 — 7/8 Cap.

WRITE FOR BULLETIN DESCRIBING BOTH MACHINES

EST. TF 1834

THE TAYLOR & FENN CO. HARTFORD 1, CONN.

If you have a SPECIAL PROBLEM

in any of these operations, where precision work is demanded and where greater production at man-hour savings is paramount—

• BORING—rough, semi-finish and finish • MILLING (special types) • STRAIGHT LINE DRILLING • UNIVERSAL ADJUSTABLE SPINDLE DRILLING • HONING • TAPPING • REAMING • COUNTERBORING • VERTICAL AND WAY-TYPE EQUIPMENT

then a Moline Multiple Spindle Specially Designed machine tool is your answer. Moline tools are ruggedly built and engineered to fit your PARTICULAR requirements, they're made to last for years, they're easy to change over to other jobs, they do better work at less cost and stand up to it longer.

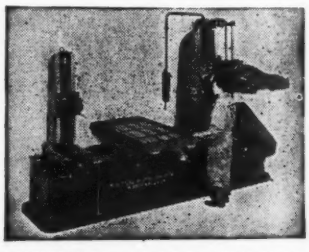
For YOUR special problem, go "HOLE-HOG," write us for any information you may need.

MOLINE TOOL CO. HOLE-HOG MOLINE, ILLINOIS

MOLINE TOOL CO.
100 20th Street Moline, Illinois

UNIVERSAL Horizontal Boring Machine
The only TRIWAY Boring Machine Built

Made in 3", 4" and 5" spindle sizes. Write for complete, detailed specifications. Represented throughout South America by Machine Affiliates.



Standard Universal 3" Spindle Machine

UNIVERSAL BORING MACHINE CO.
Hudson, Mass., U. S. A.

LUCAS "PRECISION"

Horizontal Boring, Drilling and Milling Machine

THE LUCAS MACHINE TOOL CO.
CLEVELAND, OHIO, U. S. A.

NOW AND ALWAYS OF

JONES MACHINE TOOL WORKS, Inc.

Manufacturers of

VERTICAL SHAPERS • SLOTTERS • STRAIGHT EDGES
VERTICAL BORING MILLS
HORIZONTAL BORING MILLS
SURFACE PLATES AND SPECIAL MACHINERY

King of Prussia, vicinity of VALLEY FORGE, PA.

WHERE HAVE YOU SEEN PRICES LIKE THESE?

Adjustable MULTIPLE SPINDLE DRILL HEAD

Adaptable to 14" x 17" Machines
6" Drilling Area

HEAD CAN BE FURNISHED WITH 3 TO 8 SPINDLES

1/4 CAPACITY
21/32 CENTERS

PRICES

3	Spindle	Head	$150.00	6	Spindle	Head	$170.00
4	"	"	155.00	7	"	"	180.00
5	"	"	160.00	8	"	"	200.00

US HEADS SINCE 1915

• *Delivery in Two Weeks*

UNITED STATES DRILL HEAD CO.
CINCINNATI 4, OHIO

NEW "TRU-GRIP" TAP HOLDER

Lighter, more accurate, this tap holder drives the tap by the square of the shank—holds it in alignment by the round—tap shanks are never "chewed up."

NEW features that mean
Better Tapping

This new high speed Procunier Tapping Head is the answer to your toughest tapping problems. It is a precision machine which assures greater tapping accuracy at high speed—with less tap breakage. Check these new Procunier features:

✓ New double-cone cork faced friction clutch engages the conical surfaces of the drive and reverse shells, driving the tap with a soft "cushioned" action.

✓ New clutch instantly "slips" if tap strikes bottom or sticks—reducing tap breakage.

✓ High sensitivity of Procunier Tapping Head makes it possible to detect quickly dull or "loaded" taps by the pressure needed to drive them.

✓ Procunier Tapping Heads have heat treated gear mechanism, ball bearings, light weight aluminum housings as well as many other advanced features.

A complete line of Procunier Tapping Heads is available, including Cover Clamping models — write today for illustrated bulletins.

Procunier
Safety Chuck Company
16 S. CLINTON ST., CHICAGO 6, ILL.

MAIL TODAY

PROCUNIER SAFETY CHUCK CO.
16 S. Clinton St., Chicago 6, Ill.

Send me bulletins on ☐ Procunier High Speed Tapping Heads ☐ Procunier "Tru-Grip" Tap Holders ☐ Universal Tapping Machines.

Name.....

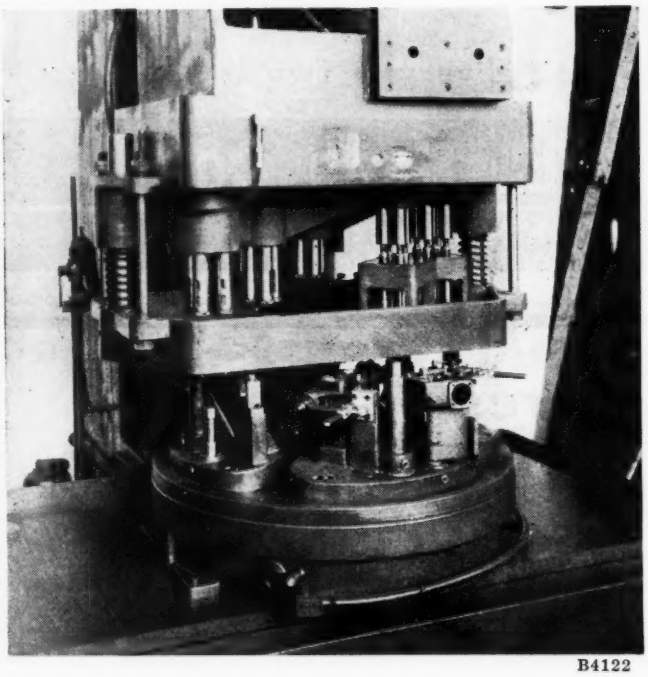
Address.....

City.....State.....

140 PIECES
Per Hour

Drills, Countersinks and Taps Eight Holes on Two Faces of Steering Gear Housing . . .

Improvements and refinements in design to step up production has been Buhr's specialty for over 25 years . . . Precision mass production means greater profits for manufacturers, and BUHR ENGINEERS are available to analyze your products and set up special equipment for more production in your plants.



B4122

BUHR RETOOLING FOR EFFICIENCY

24-Spindle Ball Bearing Buhr Shaved Gear combination drill and tap head, mounted on a special bracket carrying drill and tap motors. Oil pump provides positive lubrication.

Bushing Plate has lead screw nuts to give positive lead to taps.

4-Station holding fixture which clamps two pieces in each station is mounted on 36" index table with four indexing positions.

Electrical safety devices are incorporated to insure correct positioning before cycling.

This Machine drills, countersinks and taps eight holes on two faces of steering gear housing at the rate of 180 pieces per hour at 80% efficiency.

BUHR Machine Tool Co.
843 GREEN ST.
ANN ARBOR, MICH.

Precision grinding for aircraft – supremely important is a fine criterion for surface grinding – and this thrust bearing ring is a typical example of the wide scope and versatility of ARTER GRINDERS. Innumerable aircraft engine parts are ground rapidly to close tolerances by ARTER ROTARY SURFACE GRINDERS.

ARTER GRINDING MACHINE COMPANY
Worcester 5, Massachusetts – U. S. A.

DAVIS
KEYSEATERS

LESS IDLE TIME
Even on Varied Work!

All types of work—straight or tapered as much as 3" per foot—can be set up in a few minutes on the Davis Keyseater. Even when jobs are varied, a change of set-up or a change of cutters requires very little time. And, to finish the job, Davis Multiple Tooth Cutters make quick work of keyways up to 1¼" in width.

You can use Davis Keyseaters profitably on job work or high production!

Send for bulletin

DAVIS KEYSEATER COMPANY
405 EXCHANGE ST.
ROCHESTER 8, N. Y.

SPECIFICATIONS

Maximum length that can be ground.....13½"
Maximum width that can be ground.....6"
Maximum space under 7" wheel to table.....11½"
Maximum space under 7" wheel to Browne & Sharpe No. 510 Magnetic Chuck†.....8"
Maximum diameter cup wheel with standard guard in place.....3½"
Maximum diameter of wheel.....7"
Required diameter wheel hole..1¼"
Table surface.....5¾" x 13"
Traverse feed, one graduation...001"
Maximum vertical adjustment of wheel by means of micrometer..⅜"
Graduations, vertical adjustment.....0005"

Catalog No. 24-105 — Toolmaker Surface Grinder (for 1425 and 1725 RPM motors) with cast iron legs, wheel adapter, holder for wheel dresser, one V-belt and two-step motor pulley (for 50 or 60-cycle service) with ½" bore. Without wheel, motor, or switch. Shipping weight 670 lbs.....

$354.00

†No. 510 Browne & Sharpe Magnetic Chuck not included as original equipment.

Immediate Delivery...

from your Delta distributor's stock

Now you can get your Delta Toolmaker* Surface Grinder!

You add to the life of your tools, at lower cost — with this husky, big-capacity Delta Toolmaker Surface Grinder. You make a big saving on initial cost, and enjoy ease and speed of operation on surface grinding, tool sharpening, etc.

The Delta Toolmaker Surface Grinder is on your distributor's sales-floor now. Inspect it there, to learn of the many famous Delta Toolmaker operating advantages. They include: Convenient controls . . . Wide micrometer graduations, for close settings . . . Unique wheel adapter that saves time and redressing.

Have your distributor also show you how — with simple attachments — this versatile machine becomes an efficient tool and cutter grinder or a chip-breaker grinder.

Your nearby Delta distributor is listed under "Tools" in the classified section of your telephone directory. See him soon.

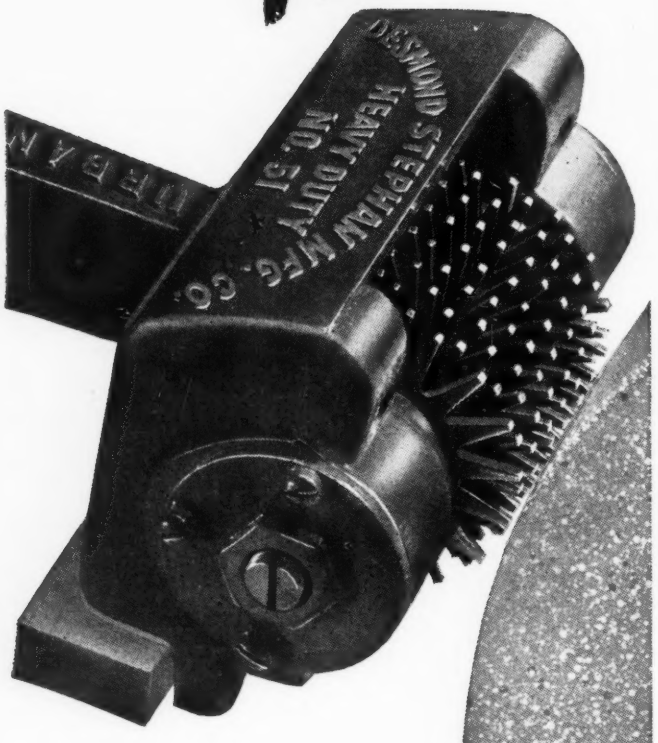
DELTA MANUFACTURING DIVISION
ROCKWELL MANUFACTURING COMPANY
MILWAUKEE 1, WISCONSIN
General Sales Office • 6 NORTH MICHIGAN AVENUE, CHICAGO 2, ILLINOIS

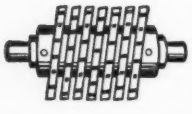
*Trade Mark Reg. U.S. Pat Off.

M-23

Your Delta distributor is now showing Delta Cut-Off Machine . . . Delta Super-Hi*-Speed Drill Presses . . . Delta 17" Drill Presses . . . Delta Multiple-Spindle Drill Presses . . . Delta Abrasive Finishing Machines . . . Delta Metal-Cutting Band Saw . . . Delta Toolmaker* Grinders.

Heft plus





Plus cutters set at an angle to give an extra *shearing* effect (as well as picking action of the Huntington-type cutters). This *Heavy Duty Dresser,* an exclusive *patented* Desmond design, is fastest and best for high-speed, specially bonded wheels. Cutter spindle mounted in dust-protected ball bearings, a *must* for this type of service. Cutters replaced quickly without bearing adjustments. Buy from your mill supply distributor. Write for complete catalog.

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the only complete line of grinding wheel

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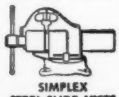
BALL BEARING DRESSERS

REVOLVING CUTTER TYPE DRESSERS

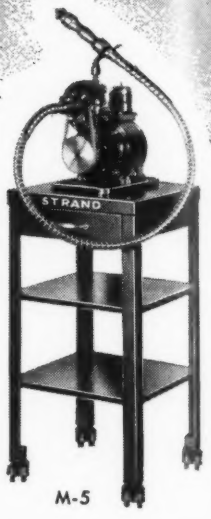
DIAMOND HAND TOOLS AND NIBS

WHEEL TYPE DRESSERS


SIMPLEX STEEL-SLIDE VISES

You can do any of these jobs FASTER-EASIER-BETTER with Strand Flexible Shaft Machines

Grinding • buffing • polishing • sanding • drilling reaming • rotary filing wire brushing • screw driving • nut setting • wood filler rubbing • rasping



M-5

Strand machines provide PORTABLE rotary power at CONSTANT speeds with dependable results and less operator fatigue. Ruggedly built for years of steady use. Hundreds of attachments easily interchanged—125 types and sizes—vertical and horizontal models from ⅛ to 3 H.P.

DISTRIBUTORS IN ALL PRINCIPAL CITIES

Send for CATALOG showing complete line.

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5011 NO. WOLCOTT AVE.
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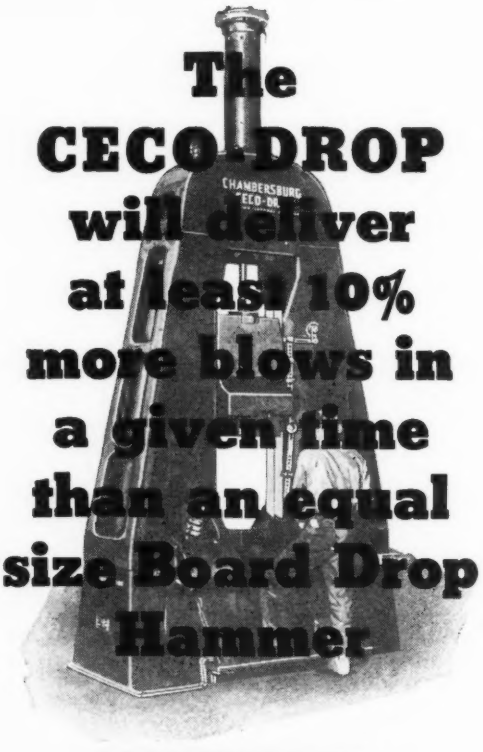
The CECO-DROP will deliver at least 10% more blows in a given time than an equal size Board Drop Hammer



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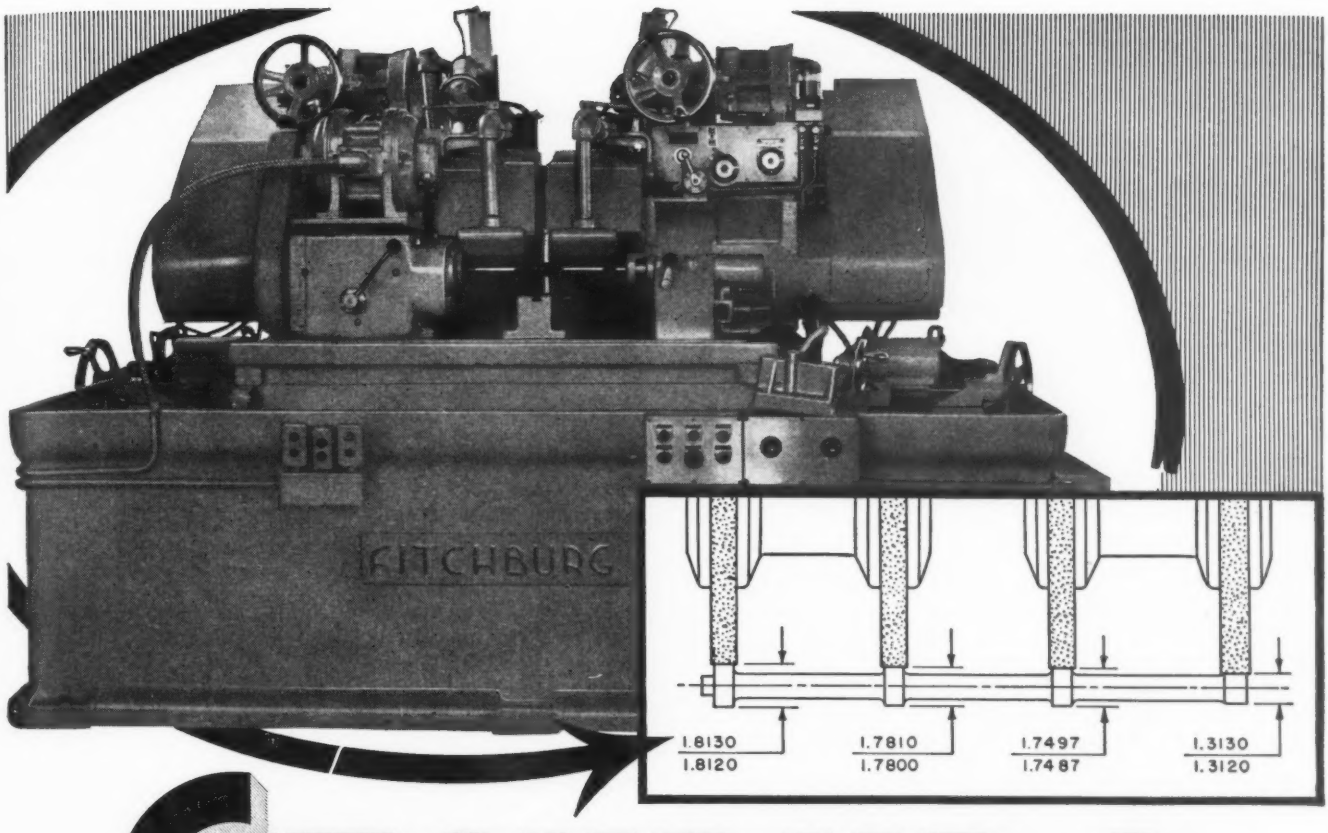
1897 • Fiftieth Anniversary • 1947

CHAMBERSBURG ENGINEERING CO. • CHAMBERSBURG, PA.



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IS AUTOMATICALLY BETTER GRINDING CAMSHAFT BEARINGS

It's not difficult for Fitchburg to design and build surprisingly inexpensive, special purpose, automatic cylindrical grinding machines. We simply take one or more Fitchburg Bowgage Wheelheads—the most efficient, completely automatic cycle wheelheads made—and place them on a suitable base.

The result is an automatic mass-production grinding machine that is *easy* on its operator—*easy* on your tool budget—and enables you to produce at an amazingly low cost-per-piece.

An example is the illustrated Two-Head Fitchburg Grinder used for grinding the four bearings on a camshaft. Each of the two Standard Bowgage Wheelheads (one right-hand and the other left-hand) carries two spaced wheels on a wheel center.

All four camshaft bearings are ground at the same time—in one operation—*at one push of a button.* All movements, and correct sizing, are completely automatic. The work stops rotating automatically, practically instantly, when the wheels withdraw. About the only attention necessary is loading and unloading the work-pieces.

Let us study *your* cylindrical grinding problems for the attainment of maximum profitable production. There is no obligation for this service.

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FITCHBURG, MASSACHUSETTS, U. S. A.

Manufacturers of—Bowgage Wheelhead Units, Multiple Precision Grinding Units, Spline Grinders, Cylindrical Grinders, Gear Grinders, Bath Full Universal Grinders and Special Purpose Grinders.

EDWARD
Blake
COMPANY

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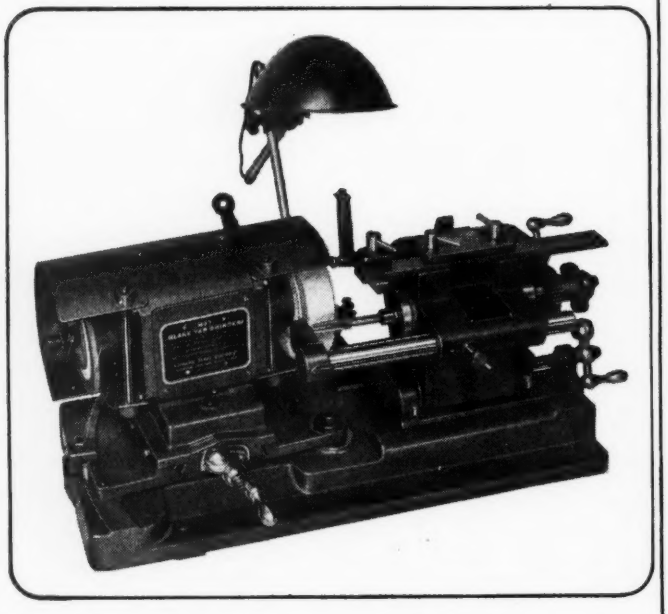

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1. TAP PURCHASES—Blake-sharpened taps last five to ten times longer—thread many more thousands of holes per tap.
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5. REDUCE SPOILAGE by cutting clean, accurate threads that easily pass inspection.

These 5-way savings can save you, in one year, many times the cost of a Blake Tap Grinder. Before you turn the page, cut out the coupon below. It'll bring you the full details of the most profitable tap grinder ever made.

Please send me Bulletin 544 which gives complete details on Blake Tap Grinders. M.

NAME_____ TITLE_____

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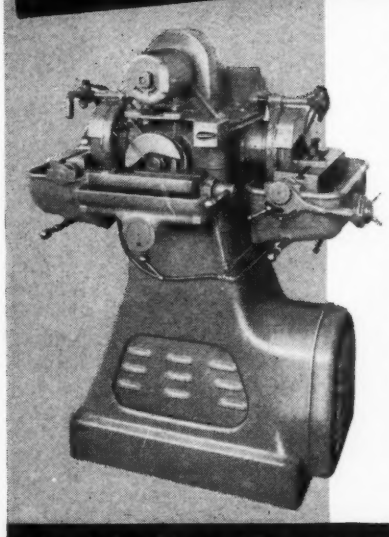
PROTECT YOUR INVESTMENT IN CUTTING TOOLS



Make sure your machines use accurately ground tools to give you most profitable operation.

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provides the accurate means for obtaining and maintaining desired angles on cutting tools. Especially efficient for grinding Carbide-tipped tools. Two grinding wheels (rough and semi-finish) and a honing wheel run on sturdy, smooth-running spindles to produce the results you demand.

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The Quality Line that's tops in Performance!

We illustrate a Metalmaster heavy duty grinder, 12", 14", 18" wheels. Available in pedestal or bench styles, 2 to 30 H. P. Carefully designed and engineered for long and heavy duty.

Manufacturers also of drills, polishers, sanders, buffers, lathes, and cam feed unit type equipment.

1840—1947

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CINCINNATI, OHIO, U. S. A.

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GENTLEMEN: Please send without obligation complete information on the Bradford line.

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The New GEARGRIND

Heavy Duty—Constant Velocity UNIVERSAL JOINT

Free From Torsional Vibrations at All Operating Angles and Speeds

Delivers CONSTANT VELOCITY Over the Entire Range

● This new high angle, heavy duty propeller shaft universal joint is now in production, after years of severe testing under extreme operating conditions! Enables the engineer to design to meet his particular requirements, because perfectly balanced, compensating joint operating angles are not required as they are with the ordinary cross type joint.

Torque is transmitted through steel balls, positioned in intersecting race ways. A heavy ball socket in the center positions the driving members and maintains true concentricity. The entire joint assembly is completely enclosed, oil being retained by a large tube, pressed on one member and connected to the other by a neoprene diaphragm. Deliveries of certain sizes are now being made.

Full Information on Request

The GEAR GRINDING MACHINE COMPANY
DETROIT 11, MICH., U.S.A.

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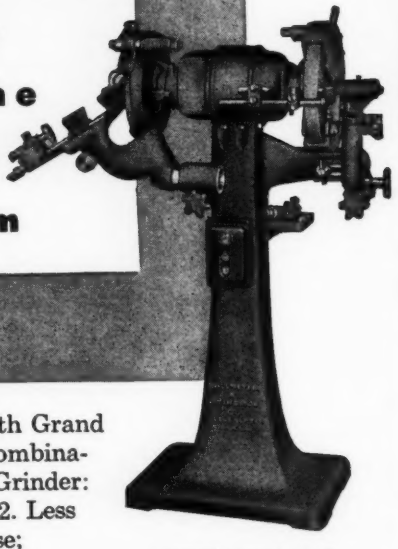
tops in the tool room



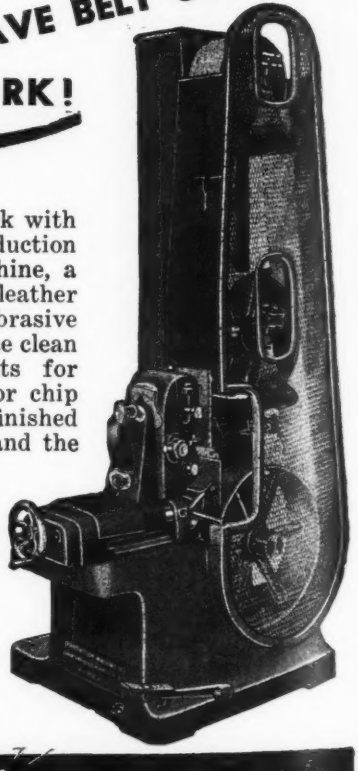
Save three ways with Grand Rapids No. 10-B Combination Tap and Drill Grinder:
1. Lower first cost; 2. Less maintenance expense;
3. Valuable floor space.

Write for Bulletin G.L. 8-46

Grand Rapids 10-B Combination Tap and Drill Grinder

GALLMEYER & LIVINGSTON COMPANY
Manufacturers of Grand Rapids Grinders
305 STRAIGHT ST., S. W., GRAND RAPIDS 4, MICH.

SAVE TIME! SAVE BELT COSTS! SAVE WORK!



No danger of scoring work with loaded belts! In the Production Type "A" Finishing Machine, a herringbone corrugated leather cushion belt, under the abrasive belt, keeps finishing surface clean by providing high points for cutting and low points for chip clearance. Work can be finished faster, belts last longer, and the centerless feed, with a capacity of ¼" to 6", gives high output without chucking, centering or holding. Get full details of this efficient, cost reducing, speed-finisher. Write for Bulletin.

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with the NEW AND IMPROVED

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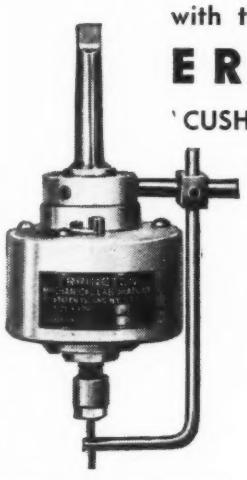
"CUSHION" CONE HIGH SPEED

TAPPER

with the 2:1 REVERSE



Ball and Bronze Bearing Throughout

Taps to 3/16 in. Steel, 1/4 in. Cast Iron

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Also:

Multiple drilling and tapping attachments, auto opening die heads, clutch tappers to 2" tap.

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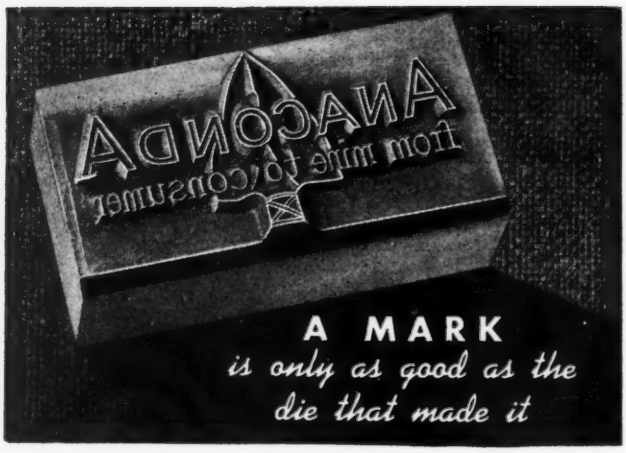

The manufacture of fine marking dies requires most exacting standards of quality plus the all important skill and know-how of master craftsmen. For good impressions and long service, only the very finest of steel, carefully heat treated, can be used. Noblewest has been making dies to these quality standards since the turn of the century. Is it any wonder that they are unexcelled for precision marking? Write Noble & Westbrook Manufacturing Co., 15 Westbrook Street, East Hartford 8, Conn.

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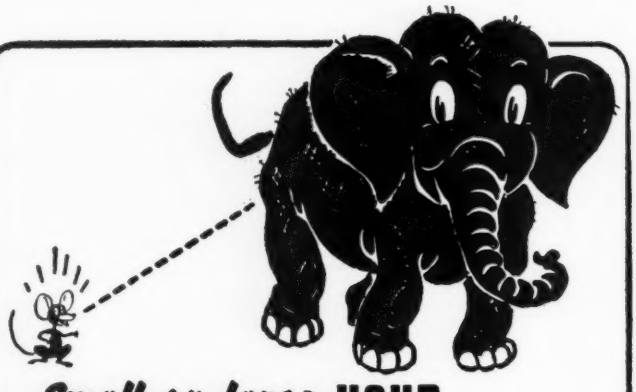
NOBLEWEST IMPROVED MARKING DEVICES

Precision Marking Dies



Small or large* YOUR TOOLING PROBLEM *receives all our technical skill

The same fine attention to detail, the same skill in design and workmanship is yours regardless of the size of your tool order. Our engineers and designers will interpret your plans and carry them through to a successful conclusion.

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COLUMBUS DIE·TOOL and Machine Co.

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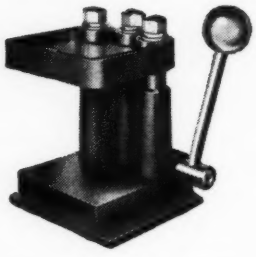
ESTABLISHED 1908

"CONE-LOK" JIGS



The Woodworth "CONE-LOK" jig utilizes the full braking power of its perfectly mated male and female cones.

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- **MECHANICAL SIMPLICITY • ADAPTABILITY**
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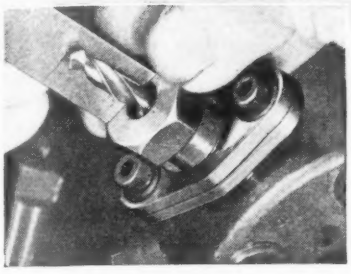
Original System of Inserted Blade

OK *Milling and Boring Tools*

See April issue MACHINERY

THE OK TOOL CO., Inc.
SHELTON, CONN.

✓New ERICKSON Adjustable Holder GIVES GREATER ACCURACY IN "Tight Spots"

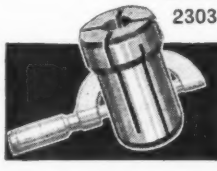


Note reduced overhang on B & S Automatic. Standard jobber drill is gripped on flutes.

Redesigned for heavier jobs, Erickson's Adjustable Floating Holder for Brown & Sharpe "00" Automatics has huskier flanges and adjusting screws. Not only longer wear and endurance; increased accuracy, too, since overhang has been reduced to 27/32" to give greater rigidity with maximum clearance. Same collet is used, each collapsing 1/32" overall. Holder grips solidly and uniformly throughout collet's length; permits stubbing, lengthens tool life. Range ¼" down to No. 80 (.013") drill.

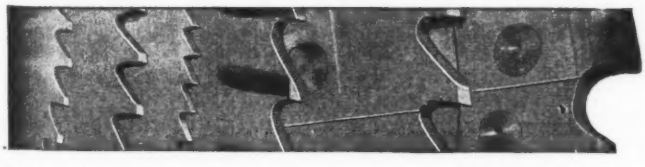
Ask for Catalog P-5 or Erickson engineer

ERICKSON TOOLS DIVISION
2303 Hamilton Ave. Cleveland 14, Ohio



ERICKSON = *Collet Chuck Precision*

SAWS for ALL METALS



Huther Bros. make the saw for your work—for brass, copper, aluminum, steel. Correct pitch, correct tooth form, correct steels—all contribute to maximum speed and efficiency. Write for our catalog of saws for every metal cutting need.

Huther Bros. Saw Mfg. Co.
ROCHESTER NEW YORK

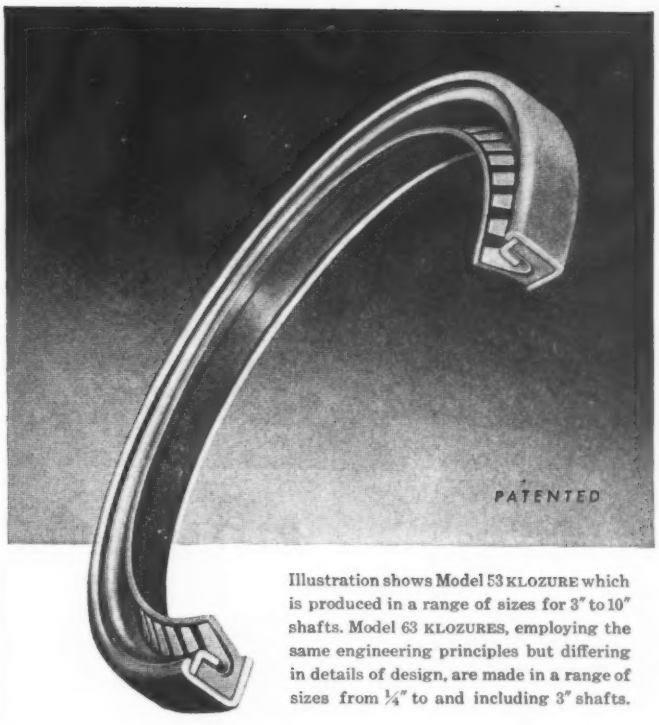
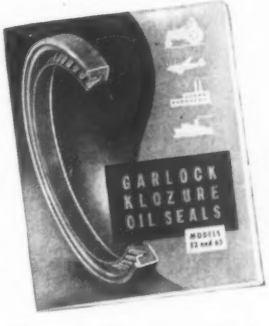


Illustration shows Model 53 KLOZURE which is produced in a range of sizes for 3" to 10" shafts. Model 63 KLOZURES, employing the same engineering principles but differing in details of design, are made in a range of sizes from ¼" to and including 3" shafts.

MODELS 53 and 63
GARLOCK KLOZURE OIL SEALS

Extreme sensitivity and flexibility of these new Models 53 and 63 KLOZURES reduce friction to a minimum and provide an efficient seal even on shafts having considerable "whip" or lateral movement. They give superior performance on high or low shaft speeds. For use under various operating conditions and on many different kinds of equipment.



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THE GARLOCK PACKING COMPANY
PALMYRA, N. Y.

In Canada: The Garlock Packing Company of Canada Limited, Montreal, Que.

60th Anniversary 1887—1947

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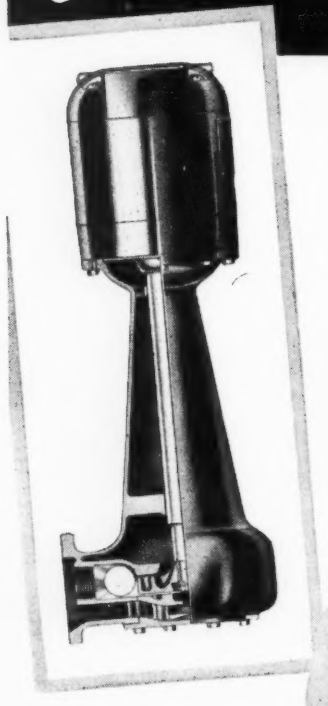
For the Best in COOLANT and LUBRICATING PUMPS.. Come to Pioneer!



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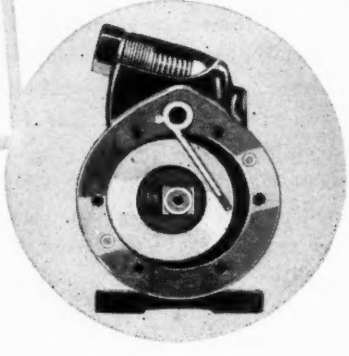
IMPELLER TYPE

Available in HORIZONTAL and VERTICAL designs, Pioneer Impeller Pumps are built for higher efficiencies, where maximum heads are required . . . conserve space for those hard to get at places . . . have long hour heavy-duty ball bearing motors for maximum life.



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POSITIVE DISPLACEMENT

The Rollway, a slow speed, positive displacement pump, for liquids with lubricating properties. Available in a variety of models under three classifications—Non-reversing, Reversing and Automatic Built-in Relief Valve.

400 STANDARD MODELS TO CHOOSE FROM

Pioneer Pumps in Impeller and Rollway designs for pumping coolants, cutting fluids, abrasive liquids, lubricants and water available in every type and size. Please specify your needs when writing for information.

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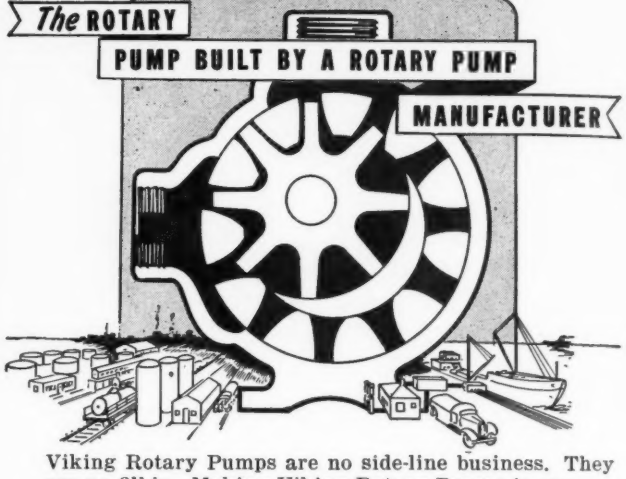
The ROTARY PUMP BUILT BY A ROTARY PUMP MANUFACTURER



Viking Rotary Pumps are no side-line business. They are no fill-in. Making Viking Rotary Pumps is our one and only job. That is why you get so much from a Viking Pump.

It's an exclusive Viking product . . . in design . . . in production . . . in service. Every effort is extended toward the betterment of this one product. Every design is based on a "gear-within-a-gear—2 moving parts" principle. All production is concentrated on this one style pump. Service is simplified by the same means. Discover for yourself this outstanding rotary pump. Write today for free folder Bulletin Series 1100J. It will be sent to you by return mail.

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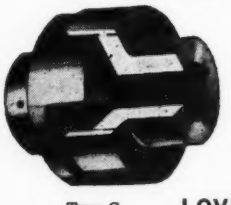
Require no lubrication, give trouble-free service with practically no maintenance.



EXTREMELY QUIET. Positive correction for misalignment, takeup of shock, vibration, oscillation, etc. For every kind of service indoors and out, 1/6 to 2500 h.p. SELECTOR CHARTS for quick finding of exact couplings needed, send for catalog. Wire or write.

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2 to 2500 h.p.
Pat. & Pats. Pend.

LOVEJOY FLEXIBLE COUPLING CO.
5021 W. LAKE ST. CHICAGO 44, ILL.
Also mfrs. Lovejoy-IDEAL Variable Speed Controls

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LIFT AND CARRY WITH

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MORGAN ENGINEERING CO.
ALLIANCE, OHIO

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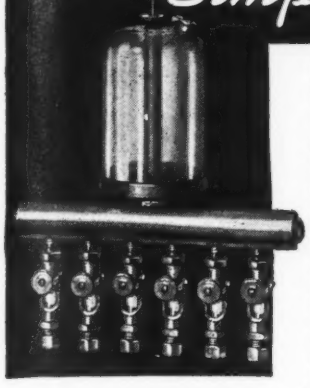

Here you have only one receptacle to watch and keep filled—a time saver and an assurance of dependable lubrication. Gits "MD" Sight Gravity Feed Multiple Oiler is a simple, practical and economical means of lubricating from 3 to 12 individual points from a central reservoir. Large capacity, transparent unbreakable plastic reservoir provides clear vision of oil contents at all times. A shut-off valve is located at the top of the transparent reservoir to prevent oil flow to the horizontal oil chamber when machines are not operating. Each drip fitting is equipped with an individual needle valve adjustment for regulating flow of oil, which can be locked against vibration. Ask for complete information on range of models and prices. Gits Catalog No. 60 illustrates and describes a full line of Oilers, Oil and Grease Seals and Lubricating Devices—write for your copy.

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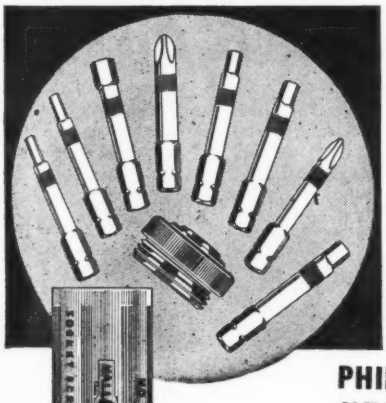

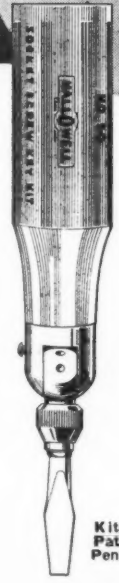

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with interchangeable tools

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For men who like to have a handy, useful set of tools, yet dislike bulk and "tool hunting", Hallowell "Socket Screw" Kits are the answer. Their tread-grip, hollow red plastic handles contain interchangeable, high-grade steel bits for most all purposes. Each has a swivel-chuck, which locks securely in any one of five positions. Kits are made in 2 sizes: No. 25, medium and No. 50, large.

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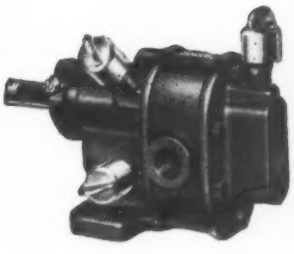

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BROWN & SHARPE PUMPS

Every shop needs these HANDIER Beam Compasses!

Instant, precise setting to any radius by simply pushing geared roller with thumb—IT STAYS PUT!

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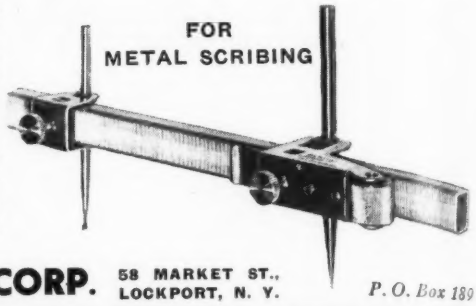

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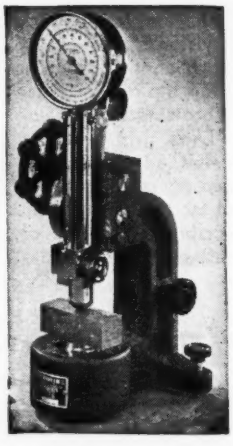

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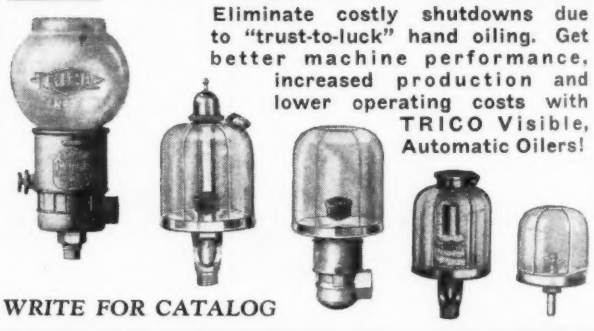

Eliminate costly shutdowns due to "trust-to-luck" hand oiling. Get better machine performance, increased production and lower operating costs with TRICO Visible, Automatic Oilers!

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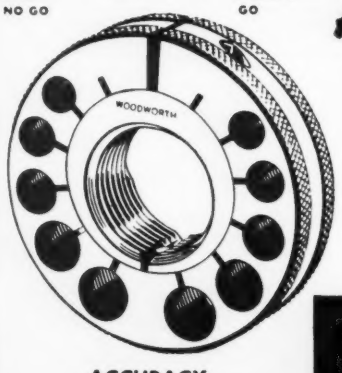
RED— NO GO Pat. Pending GREEN— GO



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FLAT HEAD CAP SCREWS provide a flush top surface

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KEEP OIL CLEAN

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Synclinal FILTER

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TRIPLE CAPACITY - TRIPLE EFFICIENCY

EXCLUSIVE SYNCLINAL DESIGN — Gives filtering area equal to 3 units of like size. By actual laboratory tests, this remarkable sump type filter not only operates with 3 times greater capacity, but permits a higher rate of flow under less pressure.

SCREENS for VARIOUS OILS & LIQUIDS— Our engineers can advise best size screens for your needs. Standard units have rigidly reinforced brass cloth with .0050" mesh.

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Removes metal particles, dirt, abrasives, and other impurities from oils that are collected and recirculated. For hydraulic machines, lathes, Coolant systems, grinding machines, etc. Write for further details.

Synclinal element gives filtering Capacity of 3 Like Size Units.

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Remember, the "ROCKWELL" Hardness Tester is made only by Wilson. And Wilson makes only hardness testers.

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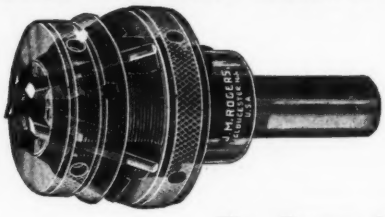
ADJUSTABLE HOLLOW MILLING TOOL



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Right Hand Cut. Left Hand Negative Rake.
Specify as type S. Carbide Tips Optional.

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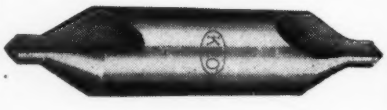
High speed. Right hand. ½" shank. Diameters from ¼" to 1½". Standard sizes in stock for immediate delivery. Complete set—41 sizes—available in sturdy, hardwood box. Saves time and money, because you always have the size you need.



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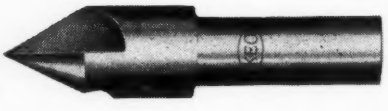

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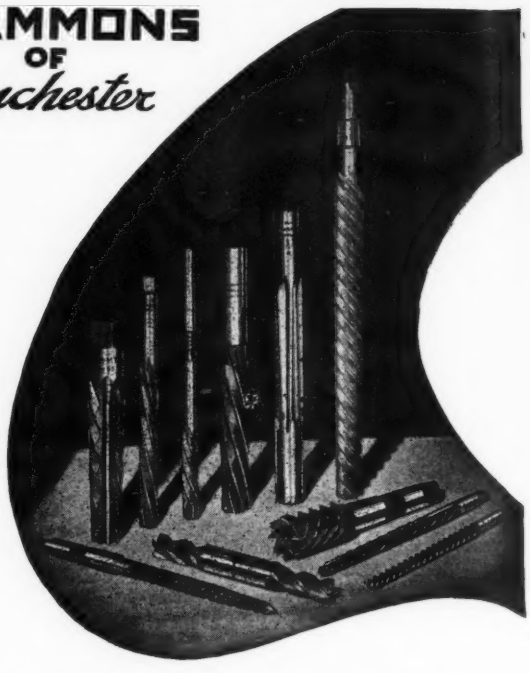

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The DI-ACRO Bender makes perfectly centered eyes from rod or strip stock at high hourly production rates. Both eye and centering bend are formed with one operation. Any size eye may be formed within capacity of bender and ductile limits of material.

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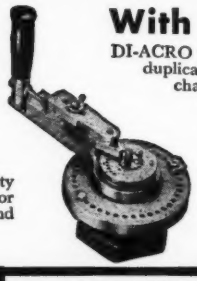

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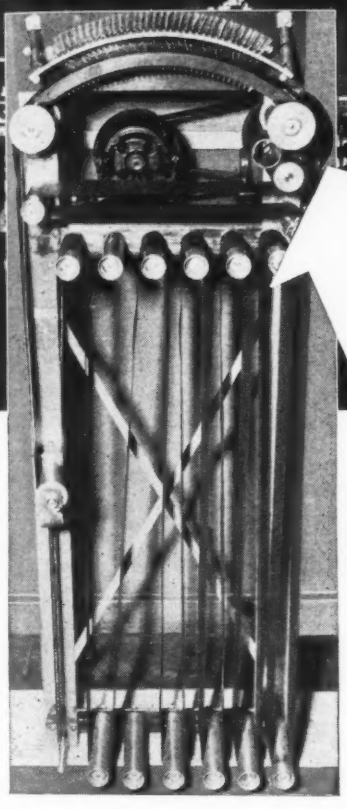

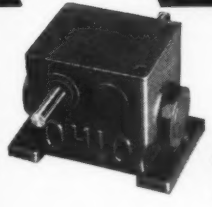

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SEVENTIETH ANNIVERSARY—FOUNDED 1877

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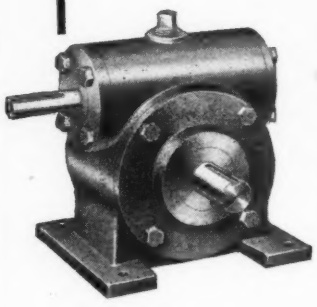
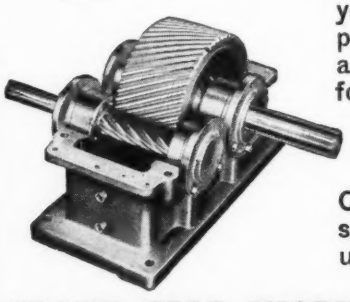


ABOVE: Style W. T., worm at top.
BELOW: Style S. H., single helical parallel shaft.



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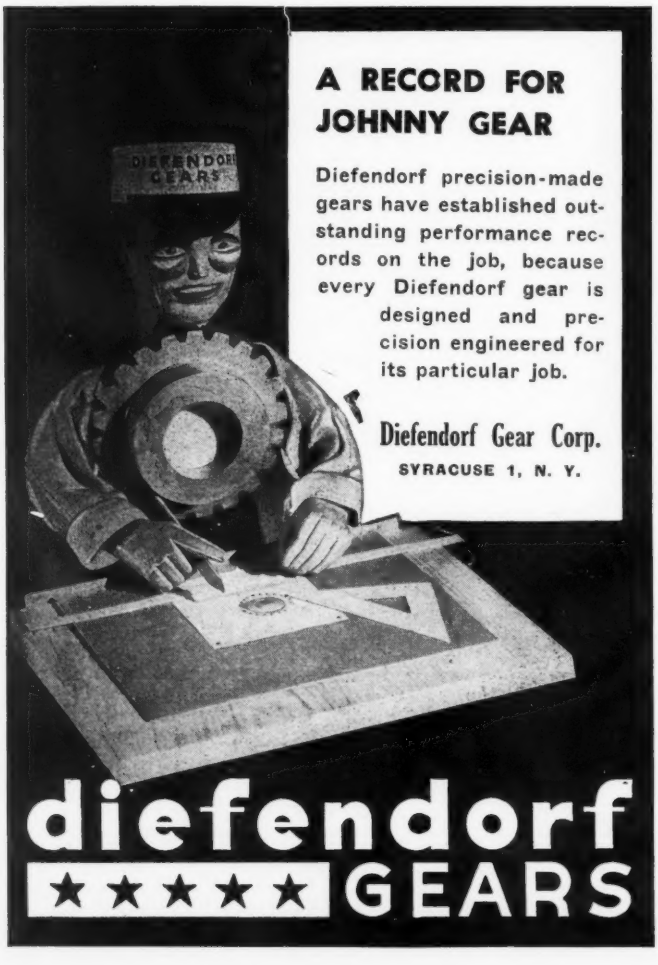
GRANT GEAR WORKS, Inc., BOSTON, MASS.



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SYRACUSE 1, N. Y.

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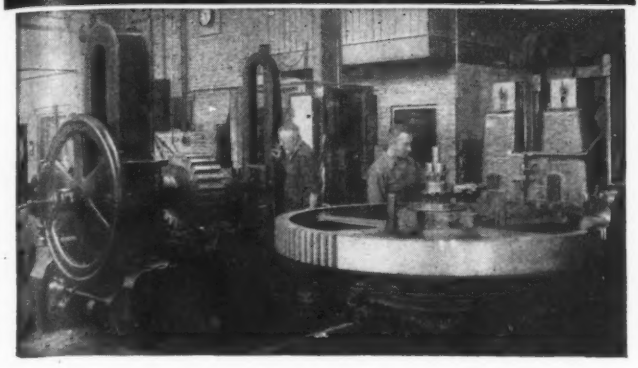
CUTTING *its first teeth!*



This big baby is getting a set of teeth that will give years of faithful service in a heavy duty installation. Stahl methods will see that every step in the process, from preliminary selection of the steel to the final inspection and shipment, are carried out by the most advanced methods, on the latest type of equipment, under the supervision of men with years of practical experience. For spurs to 72" PD, 1 DP . . . bevels to 54" PD, 1 DP . . . spirals and helicals to 38" PD, 2 DP . . . worm gears to 48" PD, 2 DP . . . fabroil, bakelite or rawhide gears any size . . . racks to 20' long, 3 DP . . . internals to 25" PD, 3 DP—get a Stahl estimate first!

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GEAR NOISE . . . DEMORALIZES

QUICKENS TEMPERS • SAPS STRENGTH
LOWERS PRODUCTION

Silent G-E nonmetallic gears eliminate demoralizing gear noise. Two types are available to benefit a wide variety of applications.

G-E FABROIL
Gears for heavy-duty applications consist of compressed cotton fibers held together by steel shrouds and threaded studs.

G-E TEXTOLITE
Gears for lighter jobs consist of numerous layers of woven fabric held in compression by a phenolic resin.

BOTH ARE STRONG • SILENT • RESILIENT

For complete information contact your gear cutter. For the bulletin, "Silent Gears," write to Section X-6, Plastics Division, Chemical Department, General Electric Company, One Plastics Avenue, Pittsfield, Mass.

GENERAL ELECTRIC

CD47-F2

NOW! Sier-Bath makes CONIFLEX GEARS

For greater design freedom . . . Faster assembly . . . Reduced wear

SIER-BATH recently installed a Gleason Gear Generator to make Coniflex Gears (straight bevel gears with localized tooth bearing) available to its customers. This feature permits small displacements of the gears under operating loads without concentration of the load on the ends of the teeth. It also saves assembly time by allowing a tolerance in mounting the gears.

In generating Coniflex Gears the tool cuts slightly deeper in the ends of the teeth than at the center. This makes the gear tooth slightly crowned at the center—localizing tooth contact at that point.

Precision machinery plus engineering "know-how" at Sier-Bath can solve your gear problems. Write for information now.

GEAR RANGE:

• Spur, helical and worm gears to 48" Dia. 3 D.P. and finer; straight tooth bevel gears 32 pitch to 3 pitch, up to 23" P.D. depending on ratio. Gears shaved from 1" to 24". Continuous Tooth Herringbone Gears generated by Sykes Method up to 37" O.D. Worms and threads precision ground on J. & L. Thread Grinder to extremely close tolerances. Spur gear grinding up to 16" diameter. Helical gear grinding up to 10" diameter. Involute and straight side splines up to 42" between centers.

ALSO MAKERS OF SIER-BATH SCREW AND GEAREX ROTARY PUMPS

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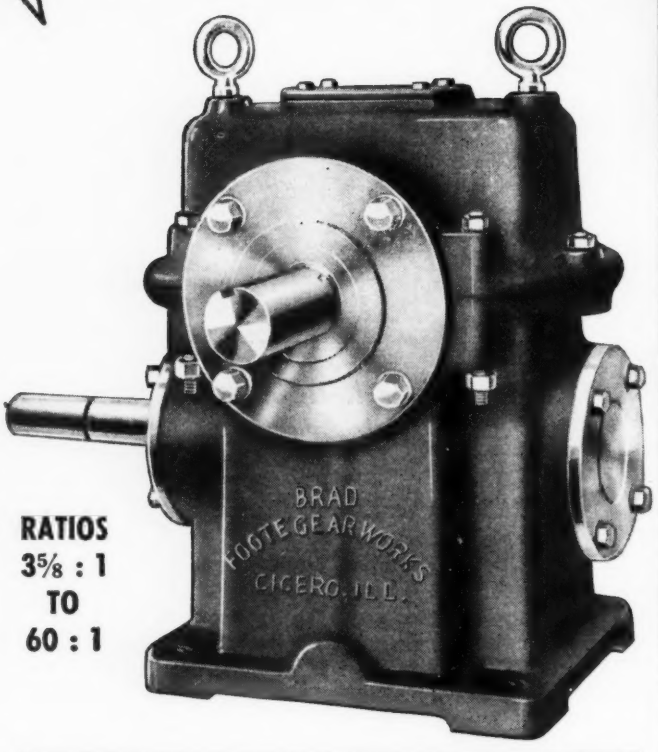
WORM GEAR SPEED REDUCERS



RATIOS
3⅝ : 1
TO
60 : 1

Brad Foote now has a small stock of Worm Gear Speed Reducers and Gyro Speed Reducers, also, many ratios which have been processed to the point of stocking. Send for Speed Reducer List showing ratios on which deliveries may be made promptly. Will give actual delivery date and prices on application.

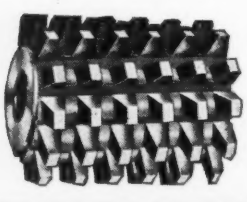
Brad Foote Gears

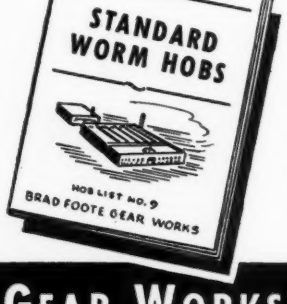
700 STANDARD WORM HOBS!

In Stock Ready for Use

Get our 12 page Bulletin No. 9 showing all dimensions in detail. These hobs are not for sale, being solely for customer use.

Send for Worm Hob List No. 9





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such as fishing reels, timing devices, control motors, etc. often require small gears with specially designed teeth.

Beaver Gear engineers are trained to assist you in the design and application of these gears. In our modern plant, craftsmen — with many year's experience in manufacturing gears — work with the latest type of equipment to assure you of receiving gears machined precisely to your specifications.

We invite you to submit your prints for quotation without obligation.

MEMBER OF AGMA

Write for copy of our new bulletin describing Beaver Gear facilities and methods.

Beaver Gear Works Inc.

1027 PARMELE ST. ROCKFORD, ILLINOIS

And now - "ZEROL" GEARS

Testing a large pair of Zerol gears, 15 x 36 combination, 1 D.P. These gears were cut on a Gleason Planing Generator for large spiral bevel gears. Although the teeth appear to be almost straight, they are actually slightly curved from end to end. The difference in curvature between the gear and pinion teeth controls the length of tooth contact.

. . . by PHILLIE GEAR . . . up to 48" diameter

Zerol gears are curved-tooth bevel gears with zero-degree spiral angle. *They combine the localized tooth contact of spiral bevel gears with the low thrust loads of straight bevel gears.*

Localized tooth contact results in smoothness, quietness and strength, even under extremely high loads. For these reasons Zerol gears are replacing straight bevel gears in many applications where thrust limitations prevent the use of spiral bevel gears.

Like straight bevel gears, Zerol gears have the advantage of no inward axial thrust under any conditions. In fact, with zero-degree spiral angle, the thrust loads are the same as for equivalent straight bevel gears, with the result that Zerol gears can be substituted for straight bevel gears, without change in thrust bearings.

Zerol gears, like other bevel gears, are designed with long and short addendum tooth proportions for smooth, quiet operation, and with large fillet radii for maximum strength.

Large Zerol bevel gears, when required, have their teeth (only) hardened on our own surface hardening machine, while smaller ones, where necessary, are hardened by the induction, straight heat treating or case hardening methods.

These gears give localized tooth bearing, which decreases stress, greatly lengthens gear life, and minimizes breakage.

We are in a position to cut gears of the Zerol bevel type up to 48" in diameter. Write us for further information.

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Industrial Gears and Speed Reducers
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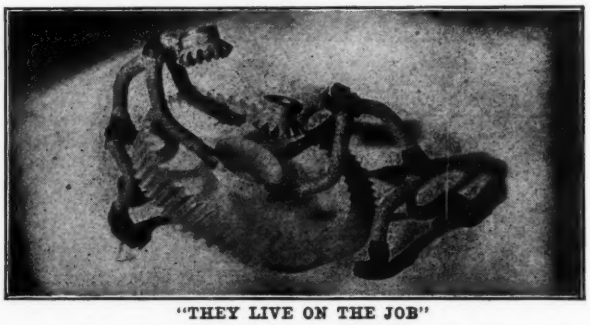
WE MEET THE DEMANDS AS THEY APPEAR



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Mass Gears ARE UNUSUAL

Massachusetts Gear & Tool Company

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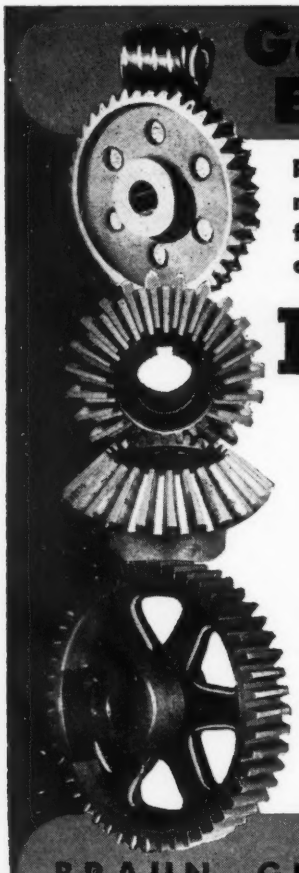

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Braun has complied with manufacturer's specifications, delivery and price requirements for 38 years. This extensive experience is aided by our up-to-date plant. Braun is a reliable, economical source for gears. Send your inquiries without obligation.

BRAUN GEAR COMPANY

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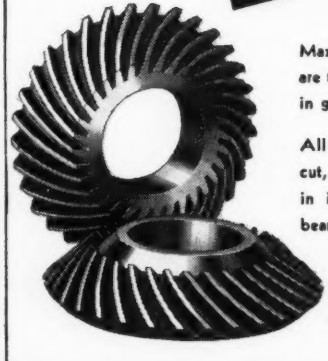

Maximum performance and dependability are two qualities that are absolutely essential in gears for any industrial purpose.

All Cincinnati Spiral Bevel Gears are cut, tested, matched, lapped and marked in individual sets . . . to insure correct bearing location on teeth.

For smooth, efficient operation at high speeds . . . specify Cincinnati Gears, *Good Gears Only!*

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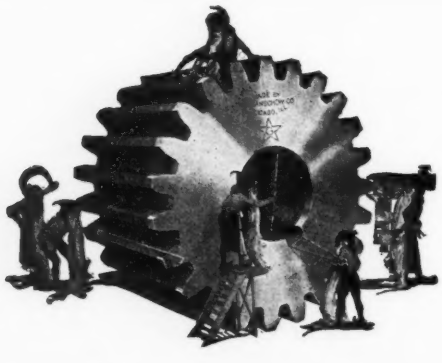

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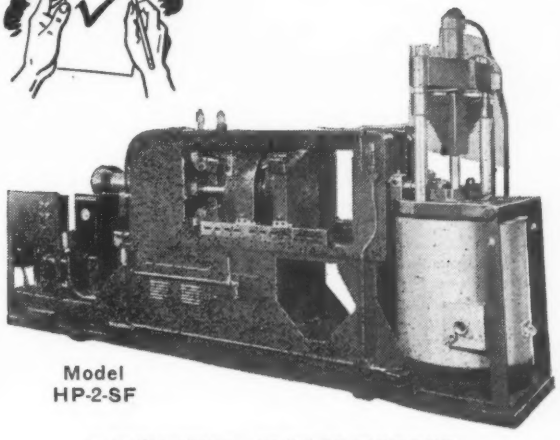
IT'S TIME TO *Check* THE RECORD ON DIE CASTING PRODUCTION



Model HP-2-SF

LESTER-PHOENIX DIE CASTING MACHINES

• This husky LESTER-PHOENIX machine die casts zinc, tin or lead over a projected area of from 200 to 400 sq. in. Zinc capacity is from 4.7 to 11.4 lbs. per shot and the die locking pressure is 300 tons . . . The same machine casts brass, aluminum and magnesium by the cold chamber method when fitted with the exclusive LESTER pre-fill injection system or the standard cylinder. Automatic core pulls may be fitted. Aluminum capacity is from 1.8 to 10.1 lbs. per shot and production is up to 350 shots per hour.

• There are four other basic models in the LESTER line in sizes ranging from 70 to 600 tons die locking pressure. All may be fitted with either the cold chamber or submerged plunger injection system, depending on the metal to be die cast.

• "Check the record" on die casting production. Compare *your own* requirements with LESTER standard ratings. Let us refer you to customers who have "checked the record" and now operate from 1 to 25 LESTER-PHOENIX machines. If you make or buy die castings, there's a spot in your plant for a LESTER.

LESTER FEATURES:

- Exclusive one piece, cast alloy steel frame.
- Exclusive system of toggle linkage transferring entire die locking pressure to the one piece frame through four metal columns.
- Larger, stronger die-height adjusting screw with supporting area equal to die area and single hand crank adjustment.
- Independent control of both injection speed and injection pressure.
- "Slow squeeze" on cold chamber injection, reducing porosity to a minimum.

Write for HERBERT CHASE'S ARTICLE OF ALUMINUM DIE CASTING.

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LESTER-PHOENIX
DIE CASTING MACHINES

Classified and Re-Sale Section

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12"x36" centers Lodge & Shipley Geared Head, m.d. in base, taper, relieving attachments
12"x84" centers Lodge & Shipley, m.d. in base, taper
13"x30" centers Pratt & Whitney Geared Head, m.d. in base, taper
13"x48" centers Pratt & Whitney, m.d. in base, taper
14"x6' bed Monarch, m.d. in base
14"x8' bed Monarch, m.d. in base
14"x6' American Geared Head, m.d., taper
14"x6' Hendey Geared Head, m.d., taper
14"x6' Pratt & Whitney, cone, taper
14"x6' Springfield Geared Head, m.d. in base, taper
14"x8' Pratt & Whitney, cone
14"x96" centers Monarch Geared Head, m.d. in base, taper
16"x6' Bradford, cone, taper
16"x6' Hendey Geared Head, m.d., taper
16"x6' Lodge & Shipley Selec. Head, m.d.
16"x8' Lodge & Shipley Selec. Head, m.d., taper
18"x48" centers Monarch Geared Head, m.d. in base
18"x48" centers Reed-Prentice Geared Head, m.d., taper
18"x7' bed Hendey Geared Head, m.d., taper
18"x8' American Geared Head, m.d., taper
18"x8' Champion, cone
18"x8' Greaves-Klusman, cone, taper
18"x8' Hendey Geared Head, m.d., taper
18"x8' Lodge & Shipley, cone
18"x8' Whitcomb-Blaisdell Geared Head, m.d.
18"x72" centers Monarch Geared Head, m.d. in base
20"x8' Cisco, cone
20"x8' Springfield Geared Head, m.d., taper
22"x8' Lodge & Shipley, cone
19"x10' LeBlond Geared Head, m.d.
22"x12' Greaves-Klusman Geared Head, m.d.
23"x12' LeBlond Geared Head, m.d., taper
24"x10' Hendey Geared Head, m.d.
24"x10' Greaves-Klusman, geared head, m.d.
24"x10' Whitcomb-Blaisdell, cone
24"x12' LeBlond, cone
24"x12' Reed-Prentice Geared Head, m.d., taper
24"x14' Boye & Emmes, cone, taper
25"x10' LeBlond, cone
30"x26' Lodge & Shipley Selec. Head, m.d.
36"x21' centers Putnam Geared Head, m.d.
36"x20' centers Niles H.D. Geared Head, m.d., latest type
36"x30' bed Lodge & Shipley Selec. Head, m.d.
36"x32' centers Putnam Geared Head, m.d.
36"x28' centers Niles H.D., Geared Head, m.d., latest
50"x204" centers LeBlond H.D. Geared Head, m.d., taper, latest

RADIAL DRILLS

3' American Sensitive, belt
3' Fosdick, gear box
3' Fosdick Sensitive, s.p.d.
3½' Cincinnati-Bickford, gear box
4'-11" American Triple Purpose, gear box m.d.
4'-13" Cincinnati-Bickford, gear box on base
4' Niles-Bement-Pond Semi-Universal, m.d.
5' American Triple Geared, gear box
5' Cincinnati-Bickford Plate Hole Driller, m.d. on arm
5' Prentice, m.d.
6' American Triple Purpose, m.d. on base, 15" col.
6'-15" Carlton, gear box m.d.
6' extended to 7' Cincinnati-Bickford, m.d. on base
6'-15" Cincinnati-Bickford Super-Service, m.d. on arm
6'-15" Niles-Bement-Pond Semi-Universal, m.d.
6'-16" Western, m.d.
8'-16" American Triple Purpose, m.d. on arm
10'-22" American Triple Purpose, m.d. on arm

UPRIGHT DRILLS

24" Cincinnati-Bickford, m.d.
21" Cincinnati-Bickford Super-Service, m.d.
21" Fosdick, m.d.
28" Cincinnati-Bickford, gear box
30" Rich H.D., m.d.
32" Aurora, belt
H3 Barnes Hydram, m.d.
D4 Colburn H.D., m.d.
D8 Colburn H.D., s.p.d.
No. 25 Foote-Burt H.D., s.p.d.
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9" Pratt & Whitney Hydraulic Spur, m.d.
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6" & 11" Gleason Gear Generators

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14"x8' American Grd. Head, 12 speeds
20"x14' Boye & Emmes Q.C.B.D.
24"x10' American Grd., 8 speeds
24"x18' American Grd., 8 speeds
24"x16' LeBlond Q.C., B.D.
24"x26' Sidney Monotrol
36"x38' American Grd., 16 speeds

MILLERS
No. 2B & No. 3B B&S Plain, M.D.
No. 2B & 3B Milwaukee DOA, M.D.
No. 4 Cincinnati Plain ROA, M.D.
No. 4 Cincinnati MS, Plain, late type
No. 4H Milwaukee Plain, late type
No. 5 Cincinnati Plain ROA, M.D.
No. 2K Milwaukee Vertical, late type
No. 3 Cincinnati Vertical, Motor in base
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M-118 Van Norman Production
No. 2-24 Cincinnati Plain Auto., late type

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36"x36"x10' Gray, 2 heads, B.D.
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72"x56"x20' Cincinnati, 4 heads, M.D.
24" Cincinnati Universal Shaper, M.D.
10" P&W Slotter, Belt Drive

RADIAL DRILLS
2½', 3', 4' & 6' American Triple Purpose
6'—17" Col. American, Motor on arm
4'—15" Carlton Plain, late type

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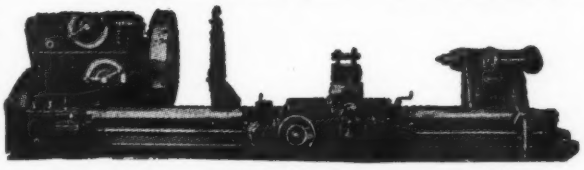
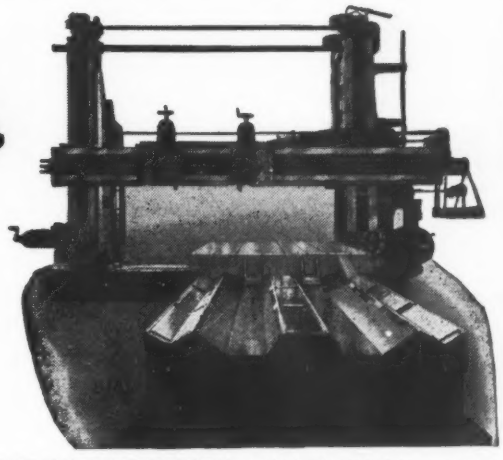
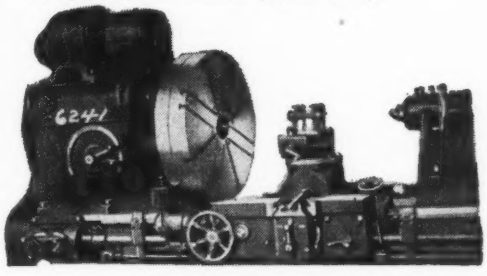


48" x 45' (35' centers) NILES (General Machinery) Heavy Engine Lathes. 16-Speed Geared Headstock, Two Carriages with PRT, AC or DC, M.D. (New 1942).
Also available 60" x 31' (20' centers) Niles, 16-Speed G.H. Lathe (New 1942).

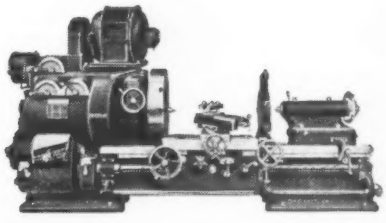


8'6"/14'x35' DETRICK & HARVEY Convertible Openside Planer, with Three Ways and Double Drive. 100-HP, 230 V, DC Reversing Type Planer Motor and Control. 4-Heads.

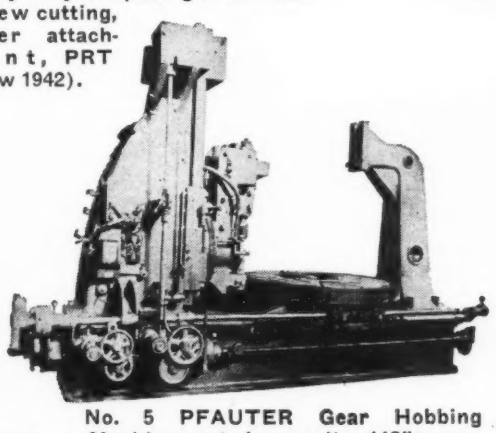


60" x 28' (15'6" centers) NILES Geared Head Heavy Forge Lathe, AC or DC (New 1942).

42" x 44' (35' centers) LEBLOND heavy duty 27-speed geared head screw cutting, taper attachment, PRT (New 1942).

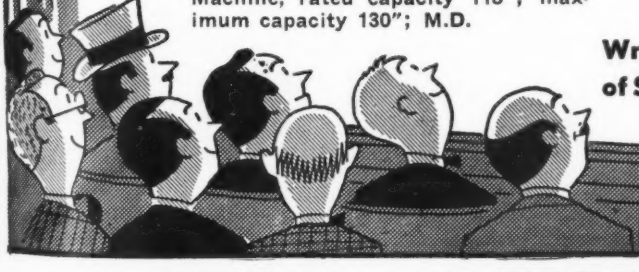


36" x 40' (32' centers) AMERICAN High Duty, 16-Speed, Geared Head, Two Carriages, AC or DC Motor.



No. 5 PFAUTER Gear Hobbing Machine, rated capacity 118"; maximum capacity 130"; M.D.

100" GOULD-EBERHARDT Gear Hobber for spur; helical and worm gears. Forced Feed Lubrication.



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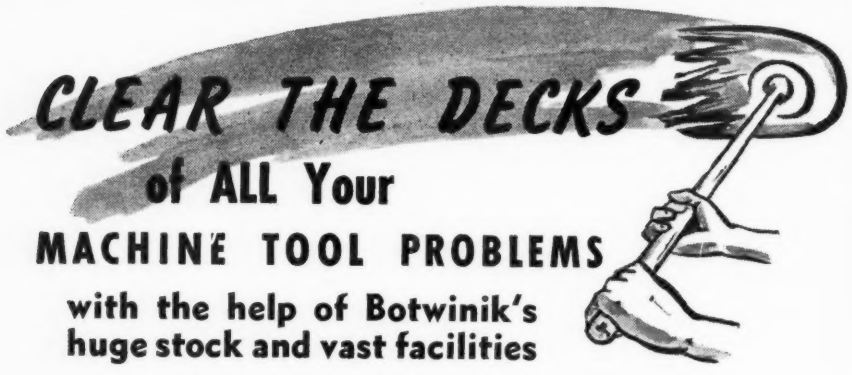
Bulletins available: General Purpose Die Heads, Insert Chaser Die Head, Threading Machines.

See our Advt on page 365 May No.

THE EASTERN MACHINE SCREW CORP., 23-43 Barclay St., New Haven, Conn. Los Angeles: A. C. Behringer, 324 N. San Pedro St., **San Francisco:** Guy Reynolds, 464 Vernon St., Oakland. **Canada:** F. F. Barber Mchry. Co., Toronto, Can.

Classified and Re-Sale Section



SCREW MACHINES

1—Conomatic 1⅞", 8 spin., vintage 1945, lg. assortment of tooling.

1—Acme Gridley Mod. B, 2¾", 4 spin., M.D., with thread, spin., lg. assortment of tooling, overhead form slides.

MILLING MACHINES

Cin. No. 3S Universal Miller, rect. overarm, motor in base.

1—Van Norman No. 2 Duplex Miller, tbl. wkg. surf. 41⅞" x 9¾", power long. feed 28", cross 11", vert. 18".

1—Van Norman No. 3 Duplex Miller, high speed mill. attachment, 12 speeds, tbl. wkg. surf. 48¼" x 10", power feed: long. 32", cross 12", vert. 18⅞".

1—B. & S. 1½A Univ. Miller, tbl. wkg. surf. 36¼" x 8¼", power feed: long. 20", trans. feed 7", vert. 18".

GRINDERS

1—Mattison Hyd. Surf. Grinder with mag. chuck, 18" x 24" x 72", power raise and lower to vert. head.

Blanchard No. 11, No. 16 and No. 18, Vertical Surface Grinders with 16", 30" and 36" Magnetic Chucks, Very Latest Type.

1—Heald No. 25 Hyd. Rotary Surf. Grinder, M.D., with auto. feed to tbl., 16" chuck.

1—P. & W. 22". Surf. Grinder, M.D., tbl. wkg. surf. 4' x 18", tbl. top to new wheel 17".

1—Farquhar 100 Ton Hydraulic Press—Daylight 48", stroke 36", approach and return speed 1600' per min. — given max. variation 15%, weight 44,000 lbs. electric equip. 440/3/60. (Condition equal to new.)

PLANERS

1—Putnam 84" x 84" x 40' Dbl. Hous. Planer, Revers., M.D. and controls, 2 hds. on cross rail, 2 side hds., just taken out of service.

1—Cin. 78" x 56" x 22', Planer, M.D., rap. trav., 2 hds. on cross rail, 2 side hds., "Herringbone Gear."

Cin. 30" x 30" x 12', 2 hds. on cross rail, "Herringbone Gear," rev. motor drive, rap. trav.

Powell 30" x 30" x 10',—2 hds. on cross rail, Planer, M.D.

1—Amer. Fndry. & Mach. Co. 30" x 30" x 10', 1 hd. on cross rail, 1 side hd., Openside Planer, M.D.

HORIZONTAL BORING MILLS

1—Lucas No. 43 precision Hor. Bor. Mill, M.D., tbl. 36" x 72", spin. diam. 4½", dist. from spin. nose to face of tailstock 84".

1—Niles No. 72 Duplex control. Horiz. Miller, M.D., 4½" bar.

VERTICAL BORING MILLS

Bullard 36" New Era Type Vert. Bor. & Turn. Mills, M.D., Capac.'s and diams. 26" and 38", heights under cross rail: 20" and 24", side hds.

2—Bullard 36" "Spiral Drive," Vert. Bor. Mills.

1—Bullard 60" Bor. Mill, 40" under cross rail, diam. wkg. tbl. 58".

1—14' Sellers. 2 hds. on cross rail, elec. equip.

LATHES

1—Bridgeford 36" x 56', 15 speed, grd. hd., Eng. Lathe, M.D., AC elec. equip. power rap. trav. to carr., compound rest. 2 steady rests, sw. 38" over bed, 26" over carr., dist. betw. cens. 48'.

Hendey 14" x 6' grd. hd. and 14" x 6' Yoke Hd., Tool Room Lathes, with taper attachments.

Hundreds of guaranteed Machine Tools are in stock available for immediate delivery. Write, Wire or 'Phone.

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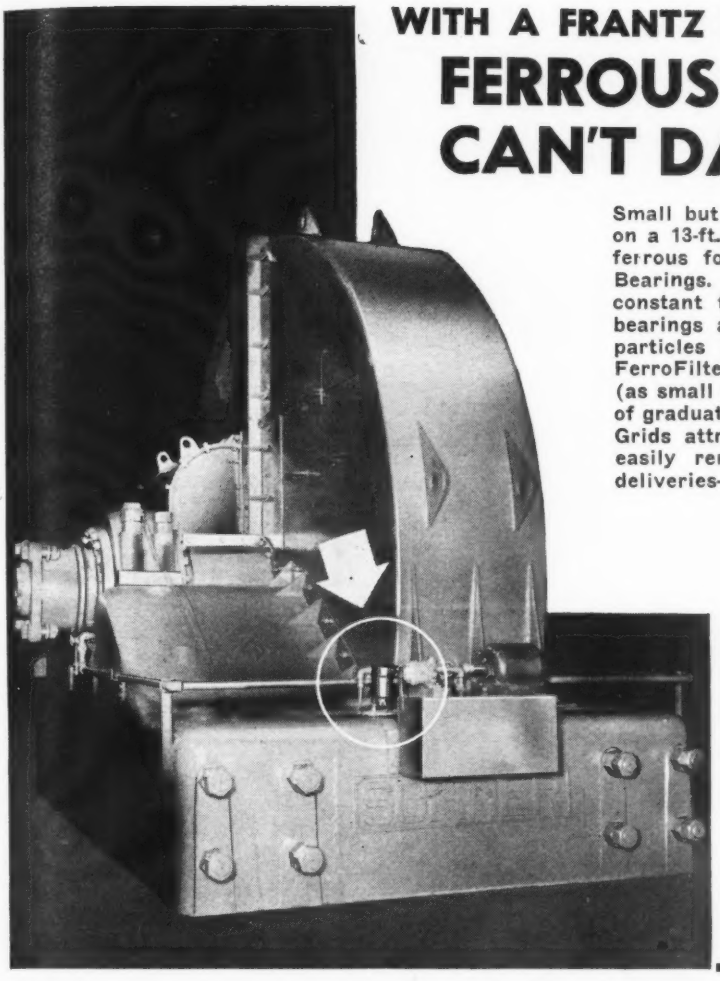

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Small but mighty! A Frantz FerroFilter (*circled*) stands guard on a 13-ft.-high Sumner Log Chipper, preventing the entry of any ferrous foreign material into the housings of the Main Roller Bearings. Fine particles of ferrous grit in lubricating oil are a constant threat of abrasive damage to the smooth surfaces of bearings and gears. The most efficient way of removing these particles is *magnetically*—with the Frantz Permanent Magnet FerroFilter, which extracts coarse and fine iron and steel particles (as small as .00004") from the circulating oil by means of a stack of graduated grids, energized by two powerful permanent magnets. Grids attract and collect ferrous particles. To clean, grids are easily removed, washed in kerosene and reassembled. Quick deliveries—write today for data and prices.

(LEFT) Sumner Iron Works of Everett, Wash., use Frantz FerroFilters on all their large log chippers. Log chipper shown here cuts 30" dia. logs at rate of 120 ft. per min.

(RIGHT) Frantz FerroFilter (fully pat.) comes in various sizes. Entirely self-contained, no power needed. Nothing to replace, no cartridges, filter elements, etc. No operating or maintenance cost.

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Gear Hobber. Type T Barber Colman
Gear Hobber. 8H, 12H & 16HS, G. & E.
Gear Shaper. No. 7 Fellows
Grinder. 4"x12" type H Landis
Grinder. 6"x18" type C Norton
Grinder. 6"x18" No. 10 Brown & Sharpe
Grinder. 10"x72" Norton type C
Grinder. 10"x96" Cincinnati type ER
Grinder. Nos. 2 & 3. Cint. centerless
Grinder. Nos. 115 & 120A Gardner opposed disc
Grinder. 53" Gardner horiz. disc
Grinders. Nos. 75A, 72A3, 72A5 Heald internal
Grinder. 10"x24" Norton hydr. surface
Grinder. 16" & 24" No. 25A Heald rotary surface
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Miller, Vertical. Kearney & Trecker, Nos. 2H, 3H & 4H.
Millers Mfg. Cincinnati, Nos. 2-24, 3-36, 4-36, 4-48, 5-48, 5-60, 5-60 duplex
Millers, Mfg. No. 12—24" Brown & Sharpe
Miller. No. 2-20 Kent Owens hydraulic
Millers, Thread. No. 3 Plan-O-Mil
Miller, Thread. Type C Lees Bradner
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Tapper. Allen No. 2 lead screw

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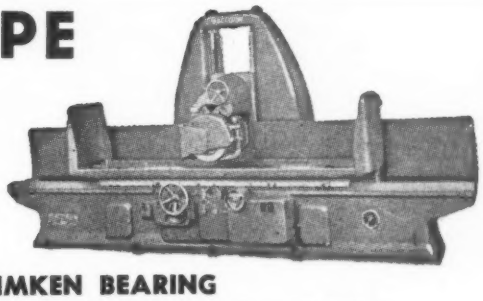

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For addresses of manufacturers listed, consult advertisements in this and previous issue. Index Pages 427-428

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Carborundum Co.
Walls Sales Corp.

ABRASIVE DISCS
See Discs, Abrasive.

ABRASIVES, POLISHING
Carborundum Co.
Norton Co.

ACCUMULATORS, Hydraulic
Baldwin Locomotive Works
Bethlehem Steel Co.
Elmes Engineering Works
Farquhar, A. B., Co.
Farrel-Birmingham Co., Inc.
Hydropress Co., Inc.
Lake Erie Engineering Corp.
Morgan Engineering Co.

AIR HOISTS—See Hoists, Air.

AIR TOOLS—See Grinders, Pneumatic; Drills, Portable Pneumatic, etc.

ALLOY-STEELS
Allegheny Ludlum Steel Corp.
Bethlehem Steel Co.
Carnegie-Illinois Steel Corp. (U. S. Steel Corp. Div.)
Carpenter Steel Co.
Chambersburg Engineering Co.
Crucible Steel Co. of America
Republic Steel Corp. (Union Drawn Steel Div.)
Ryerson, Joseph T., & Son, Inc.
Vanadium Alloys Steel Co.
Wheelock, Lovejoy & Co., Inc.

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See Presses, Arbor.

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Norton Co.
Pope Machinery Corp.
Sundstrand Mch. Tool Co.

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Gwilliam Co.
S K F Industries, Inc.

BARS, Boring
See Boring Bars.

Phosphor Bronze
Bunting Brass & Bronze Co.
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Allegheny Ludlum Steel Corp.
Bethlehem Steel Co.
Carpenter Steel Co.
Crucible Steel Co. of America
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Ryerson, Joseph T., & Son, Inc.
Timken Roller Bearing Co.
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Orange Roller Bearing Co., Inc.
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Barnes, W. F., & John, Co.
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Cincinnati Planer Co.
Cosa Corp.
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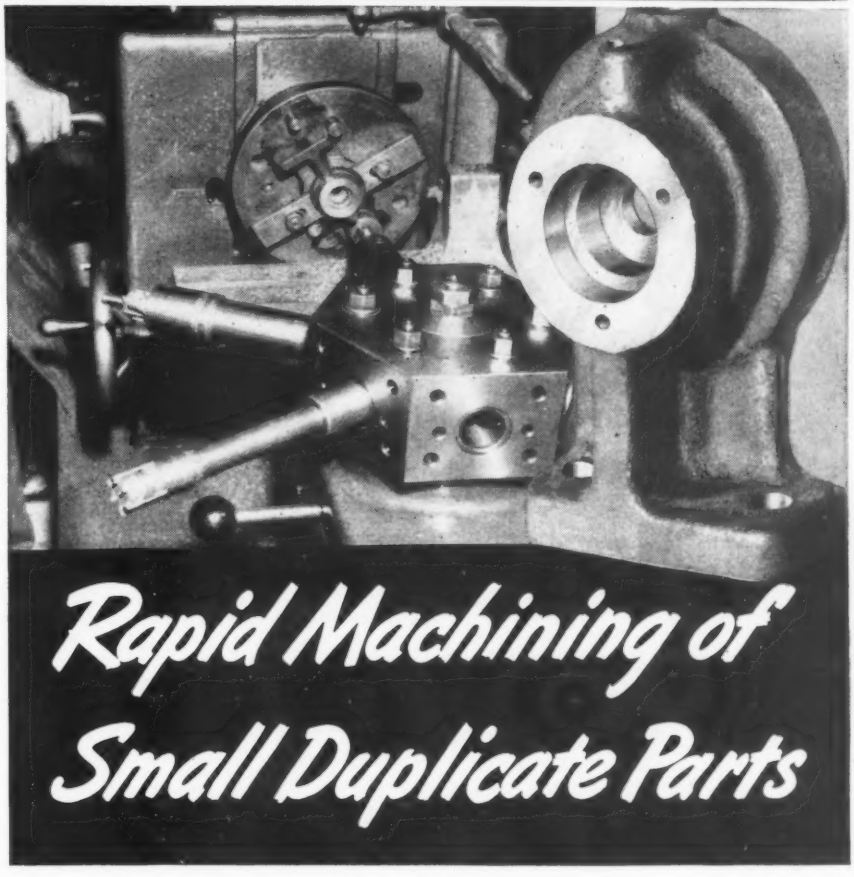

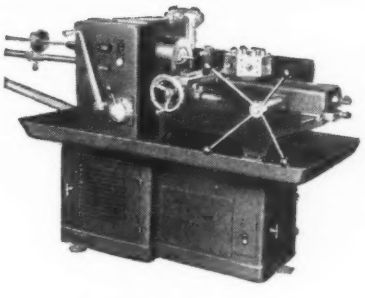

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Hanson-Whitney Machine Co.
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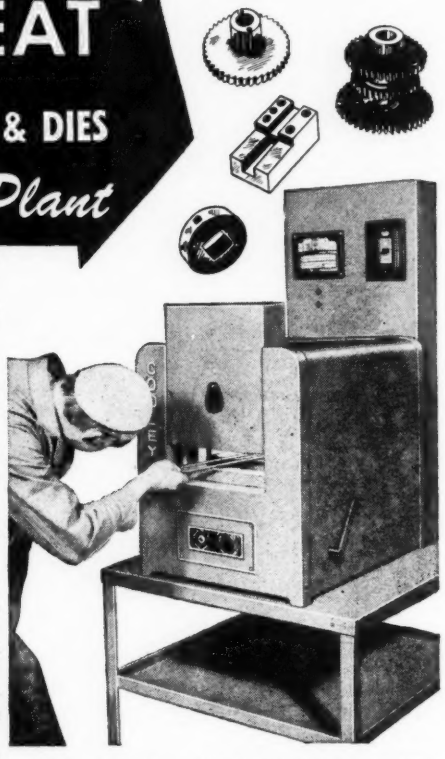
In Your Own Plant



SAVE TIME AND MONEY
with these Versatile Cooley Electric Box Furnaces

- Install anywhere by simple wire connection. Quiet in operation. No fumes or odors—no ventilating required.
- Any intelligent man can operate furnace with automatic temperature control, using established procedures.
- Operating cost under 4¢ per hour to hold 1600° F. in Model 3 furnaces, with 2¢ per kw.-hr. rate. Others in proportion.

NOW YOU CAN heat treat, harden and temper small parts in your own plant . . . *without experienced heat treaters.* Economical to install and use, Cooley Electric Furnaces operate efficiently at high or low heats, and save your large furnace time for work requiring large volume capacity. Here are some profitable uses:

PRODUCTION HEAT TREATING of small parts . . . Small batches . . . Tools and dies . . . Running pilot lots to predetermine mass production techniques . . . Emergency repairs . . . Industrial and laboratory testing . . . Miscellaneous controlled heating jobs.

VK-5 FURNACE WITH CONTROL PANEL Complete factory wired assembly—furnace, stand, controls, fuses and multi-breaker switch ready for line connection. Saves installation time and insures correctly installed unit. Mobile; movable as a unit to new locations. Panel assembly available for all present furnaces.

CHAMBER	8"W 6"H 14"L				10"W 6"H 18"L				8"W 6"H 14"L
MAX. TEMP.	1850° F.				1850° F.				2000° F.
AMPERES	14.8 at 230 v.				19.6 at 230 v.				20.2 at 230 v.
WATTS	3400				4500				4650
MODEL*	MH-3	VH-3	MK-3	VK-3	MH-4	VH-4	MK-4	VK-4	VK-5
PRICE	146.00	166.00	186.00	206.00	222.50	242.50	262.50	282.50	340.00

* M models complete with hinged door and hearth plate.
V models have counterweighted vertical lift door with adjustable opening.
K models include Selective Power Modifier for input control to correct temperature lag.

FORCED CIRCULATION AIR DRAW FURNACES — Write for data.

ACCESSORY EQUIPMENT
Electronic operated Veri-Tron Indicating and Controlling pyrometer, with thermocouple and lead wire $143.00
Same in self-contained, enclosed panel including line switch and fuses, with steel stand—completely wired 240.00
Steel stand with shelf 35.00

FREE LITERATURE
NEW CATALOG completely describes all models and applications for each. Write today for your copy . . . no obligation.

DEALERS AND DISTRIBUTORS WANTED!
Good territories open on this extensive line of self-contained small electric furnaces. Investigate now.

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INDIANAPOLIS MACHINERY EXPORT CORP.
Export Manager, 44 Whitehall Street, New York, New York

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Cincinnati Planer Co.

CHAINS, Power Transmission and Conveyor
Boston Gear Works, Inc.
Philadelphia Gear Works

CHAMFERING MACHINES, Gear Tooth
Bilgram Gear & Mch. Works
Consolidated Mch. Tool Corp.
Cross Co.
Grant Mfg. & Mch. Co.
Lipe-Rollway Corp.

CHISELS AND CHISEL BLANKS
Bethlehem Steel Co.

CHUCKING MACHINES
Baird Machine Co.
Bardons & Oliver, Inc.
Bliss, E. W., Co.
Bullard Company
Cleveland Automatic Machine Co.
Gisholt Machine Co.
Goss & DeLeeuw Mch. Co.
Heald Machine Co.
Jones & Lamson Machine Co.
National Acme Co.
New Britain-Gridley Mch. Div.
Potter & Johnston Mch. Co.
Sundstrand Mch. Tool Co.
Warner & Swasey Co.

Multiple Spindle
Goss & DeLeeuw Mch. Co.
National Acme Co.
New Britain-Gridley Mch. Div.

CHUCKS

Air Operated
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Hufford Machine Works, Inc.
Logansport Machine Co., Inc.
Schrader's Son, A.
Skinner Chuck Co.
Union Mfg. Co.

Collet or Split
See Collets.

Diaphragm
Van Norman Co.

Drill
Cleveland Twist Drill Co.
Erickson Tools Div., Erickson Steel Co.
Ettco Tool Co.
Jacobs Mfg. Co.
Lee, K. O., & Son Co.
Modern Tool Works
Morse Twist Drill & Mch. Co.
National Twist Drill & Tool Co.
Procunier Safety Chuck Co.
Skinner Chuck Co.
Standard Tool Co.
Union Mfg. Co.

Full Floating
Erickson Tools Div., Erickson Steel Co.
Errington Mechanical Laboratory
Gisholt Mch. Co.

Gear
LeMaire Tool & Mfg. Co.

Lathes, Etc.
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Cushman Chuck Co.
Erickson Tools Div., Erickson Steel Co.
Gisholt Mch. Co.
Jones & Lamson Mch. Co.
Rivett Lathe & Grinder, Inc.
Scherr, George, Co., Inc.
Skinner Chuck Co.
Union Mfg. Co.
Warner & Swasey Co.

Magnetic
Arter Grinding Machine Co.
Brown & Sharpe Mfg. Co.
Taft-Peirce Mfg. Co.
Walker, O. S., Co., Inc.

Quick Change and Safety
Erickson Tools Div., Erickson Steel Co.
Errington Mechanical Laboratory
Lee, K. O., & Son Co.
Modern Tool Works
National Tool Co.
Procunier Safety Chuck Co.

Ring Wheel
Bridgeport Safety Emery Wheel Co., Inc.
Gardner Machine Co.

Tapping
Barber Colman Co.
Erickson Tools Div., Erickson Steel Co.
Errington Mechanical Laboratory
Greenfield Tap & Die Corp.
Jacobs Mfg. Co.
Procunier Safety Chuck Co.
Skinner Chuck Co.

CIRCUIT BREAKERS
Westinghouse Electric Corp.

CLAMPS
Armstrong Brothers Tool Co.
Baumbach, E. A., Mfg. Co.
Besly, Chas. H., & Co.
Brown & Sharpe Mfg. Co.
Danly Machine Specialties, Inc.
Starrett, L. S., Co.
Williams, J. H., & Co.

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Bullard Co., Bullard-Dunn Process Div.
Oakite Products, Inc.

CLUTCHES
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Clearing Mch. Corp.
Farrel-Birmingham Co., Inc.
Formsprag Co.
Hilliard Corp.
Lipe-Rollway Corp.

"Not only to serve today, but to anticipate tomorrow"
. . . Wm. B. Given, Jr.

MEEHANITE CASTINGS
as made by BRAKE SHOE

and the metal is geared to its job

These are two herringbone gear rotors. They are the only moving parts of the motor which powers the "Turbinair" Hoists of the Joy Mfg. Co., Sullivan Division, Claremont, N. H. This sturdy equipment is widely used in the mining industry throughout the world.

Each rotor is a casting. To gear with the exacting job demands of this service, the castings selected had to be machinable, wear-resistant, vibration-dampening and strong. And, after thorough consideration, Meehanite castings as made by Brake Shoe were chosen. In this case GA-Meehanite, a high-strength type, was the right metal for the job.

When your service requires this or other types such as heat-resisting, pressure-tight and other engineered castings, you also may benefit from Brake Shoe's casting techniques and foundry experience. Write us outlining your own need for castings. Let us discuss with you a metal that gears with them perfectly . . . tell you about castings backed by Brake Shoe's laboratory research and pilot plant work in its own experimental foundry.

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Gisholt Mch. Co.
Hannifin Corp.
Hardinge Brothers, Inc.
Jones & Lamson Mch. Co.
Modern Tool Wks.
New Britain-Gridley Mch. Div., New Britain Machine Co.
Pratt & Whitney Co.
Rivett Lathe & Grinder, Inc.
Standard Tool Co.
Stark Tool Co.
Union Twist Drill Co.
Universal Engineering Co.
Warner & Swasey Co.

COMPARATORS—
See Gages, Comparator.

COMPARATORS, Screw Thread
Jones & Lamson Mch. Co.
Scherr, George, Co., Inc.

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Gulf Oil Corp.
National Broach & Mch. Co. (Broaching and Lapping)
Oakite Products, Inc.
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Stuart, D. A., Oil Co., Ltd.
Sun Oil Co.
Texas Co.
Tide Water Associated Oil Co.
United States Products Co. (Lapping)

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Ingersoll-Rand Co.

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Ex-Cell-O Corp.
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Hill Acme Co.
Kaydon Engrg. Corp.
Langelier Mfg. Co.
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Mummert-Dixon Co.
National Acme Co.
Rockford Machine Tool Co.
Taft-Peirce Mfg. Co.
U. S. Tool Co., Inc.
Wicaco Machine Corp.

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Bristol Co.
Clark Controller Co.
Westinghouse Electric Corp.

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Gairing Tool Co.
Genesee Mfg. Co., Inc.
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Morse Twist Drill & Mch. Co.
National Tool Co.
National Twist Drill & Tool Co.
Pratt & Whitney Co.
Standard Tool Co.
Starrett, L. S., Co.
Super Tool Co.
Union Twist Drill Co.

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Standard Pressed Steel Co.
Warner & Swasey Co.

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Gairing Tool Co.
Greenfield Tap & Die Corp.
Morse Twist Drill & Mch. Co.
National Twist Drill & Tool Co.
Standard Tool Co.
Super Tool Co.
Union Twist Drill Co.

COUNTERS, Revolution
Bristol Co.
Brown & Sharpe Mfg. Co.
Starrett, L. S., Co.
Veeder-Root, Inc.

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Veeder-Root, Inc.

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Farrel-Birmingham Co., Inc.
Industrial Machine Works, Inc.
Lovejoy Flexible Coupling Co.
Philadelphia Gear Works

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Dart, E. M., Mfg. Co.

Shaft
Boston Gear Works, Inc.
Hilliard Corp.
Standard Pressed Steel Co.

CRANES, Electric Traveling
Morgan Engineering Co.
Shepard Niles Crane & Hoist Corp.

Hand Traveling
Shepard Niles Crane & Hoist Corp.

Locomotives
Cullen-Friestedt Co.
Hill Acme Co.

Portable
Canedy-Otto Mfg. Co.

CUTTER GRINDERS
See Grinding Machines, Universal, for Sharpening Cutters, Reamers, Hobs, Etc.

CUTTERS, Gear
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Ex-Cell-O Corp.
Fellows Gear Shaper Co.
Michigan Tool Co.
Morse Twist Drill & Mch. Co.
National Broach & Mch. Co. (Gear Shaper)
National Tool Co.
National Twist Drill & Tool Co.
O.K. Tool Co., Inc.
Pratt & Whitney Co.
Standard Tool Co.
Union Twist Drill Co.
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Keo Cutter Co.

Milling
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Columbus Die, Tool & Machine Co.
Continental Tool Works Div.
Detroit Tap & Tool Co.
Ex-Cell-O Corp.
Firth-Sterling Steel & Carbide Corp.
Gairing Tool Co.
Gammons-Hoaglund Co.
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Gorton, George, Mch. Co.
Haynes Stellite Co.
Ingersoll Milling Mch. Co.
Kearney & Trecker Corp.
Kennametal, Inc.
Modern Tool Wks.
Morse Twist Drill & Mach. Co.
National Tool Co.
National Twist Drill & Tool Co.
O. K. Tool Co., Inc.
Pratt & Whitney Co.
Producto Machine Co.
Reed-Prentice Corp.
Severance Tool Industries, Inc.
Standard Tool Co.
Sossner, Inc.
Super Tool Co.
Union Twist Drill Co.

CUTTING COMPOUNDS
See Compounds, Cutting, Grinding, Etc.

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Avey Drilling Machine Co.
Bardons & Oliver, Inc.
Brown & Sharpe Mfg. Co.
Cochrane-Bly Co.
Consolidated Mch. Tool Corp.
DoAll Co.
Landis Machine Co.

Abrasive Wheel
Armstrong Brothers Tool Co.
Campbell, Andrew C., Div. American Chain & Cable Co., Inc.
Delta Mfg. Div. Rockwell Mfg. Co.

Cold Saw
See Sawing Machines, Circular.

CUTTING-OFF TOOLS
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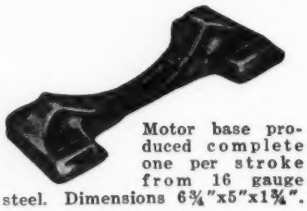
Firth-Sterling Steel & Carbide Corp.
Haynes Stellite Co.
Luers, J. Milton

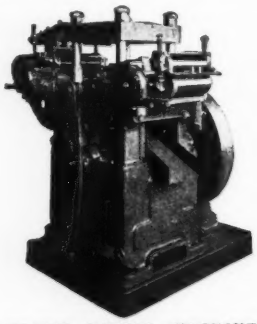
Emblem of

LOWER STAMPING COSTS

Can opener blade requiring 8 operations produced complete per stroke at greatly increased rate.



Motor base produced complete one per stroke from 16 gauge steel. Dimensions 6¾"x5"x1¾".



50-TON DIEING MACHINE
Other capacities 10 tons to 300 tons.

"Complete-per-stroke on H&W Dieing Machines"

If, in planning your stampings, you were to place the above emblem on the blueprints as part of the spex, it would be like a guarantee of rock-bottom cost. The Dieing Machine saves money, not merely because of high production rates—but because of High Production with High Precision. It is a unique "upside-down" machine with a superior automatic roll feed. It gives new high production on cleaner stampings (to precision within .0002" limits when required), with such precision of operation that dies last 600% to 1200% longer. "Complete-per-stroke on the Dieing Machine" is a practical guarantee of "greatly reduced stamping cost". Our engineers cooperate fully with you in bringing this about.

REQUEST DETAILED CATALOG 47

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Carborundum Co.
Norton Co.
Raybestos-Manhattan, Inc., Manhattan-Rubber Div.

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Cross Co.
Ex-Cell-O Corp.
Ingersoll Milling Mch. Co.
Moline Tool Co.

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Denison Engineering Co.
Hanna Engrg. Works
Hannifin Corp.
Hydraulic Products Co.
Logansport Machine Co., Inc.
Oilgear Co.
Rockford Machine Tool Co.
Skinner Chuck Co.

Pneumatic
Bellows Co.
Clearing Mch. Corp.
Hanna Engrg. Works
Hannifin Corp.
Hydraulic Products Co.
Skinner Chuck Co.

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Ruthman Mchry. Co.
Snyder Tool & Engrg. Co.

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Desmond-Stephan Mfg. Co.

DIE CASTING MACHINES
Kux Machine Co.
Lester-Phoenix, Inc.
Reed-Prentice Corp.

DIE CASTING
See Castings, Die.

DIE CUSHIONS, Pneumatic
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Clearing Mch. Corp.
Verson Allsteel Press Co.

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Firth-Sterling Steel & Carbide Corp.
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Kearney & Trecker Corp.
Oliver Instrument Co.

DIE SETS, Standard
Baumbach, E. A., Mfg. Co.
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Pratt & Whitney Co.
Producto Machine Co.

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Cincinnati Milling Mch. Co.
Gorton, George, Mch. Co.
Pratt & Whitney Co.
Reed-Prentice Corp.

DIE SINKING PRESSES
Baldwin Locomotive Works
Kearney & Trecker Corp.

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See Stocks, Die.

DIES, Lettering and Embossing
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Sossner, Inc.

DIES

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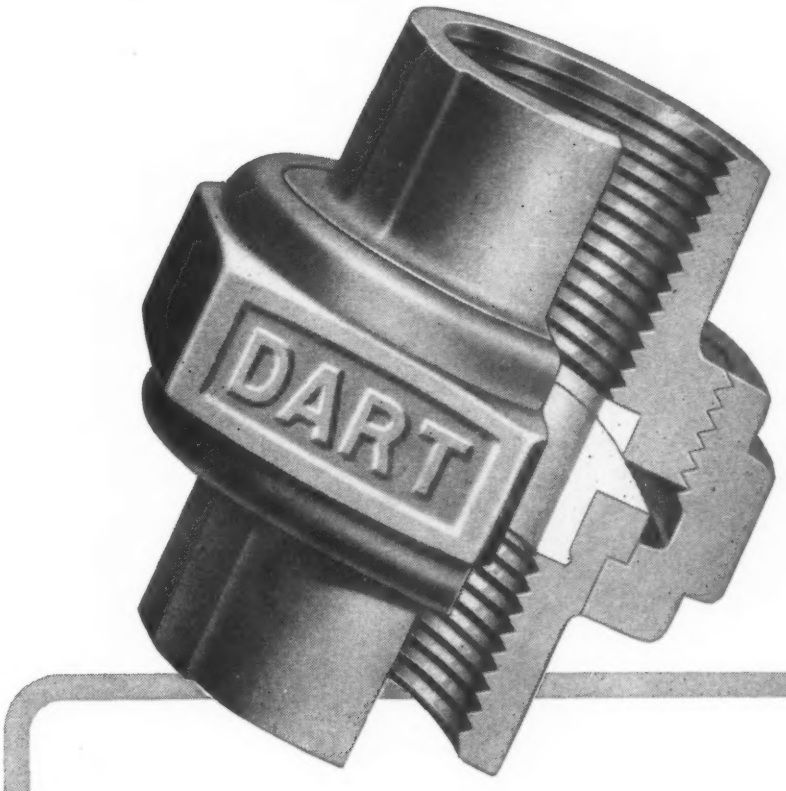
Niagara Mch. & Tool Wks.
Peck, Stow & Wilcox Co.
Pioneer Pump & Mfg. Co.
Ruthman Mchry. Co.
Taft-Peirce Mfg. Co.
Verson Allsteel Press Co.
V & O Press Co.
Waltham Mch. Wks.

Threading
Butterfield Div., Union Twist Drill Co.
Card, S. W., Mfg. Co.
Eastern Mch. Screw Corp.
Geometric Tool Co.



DART

The Union for Leak-Proof Protection

THE TWO BRONZE SEATS ARE GROUND TO FORM A TRUE BALL JOINT

Dart Unions insure leak-proof protection because their two bronze seats are *precision-ground*. This means that they fit tighter and close easily, without excessive wrenching, to a drop-tight connection. Despite length of service, they uncouple easily for use elsewhere—and they cost least in the long run. Body and nut, made of high-test, air-refined malleable iron, are practically indestructible.

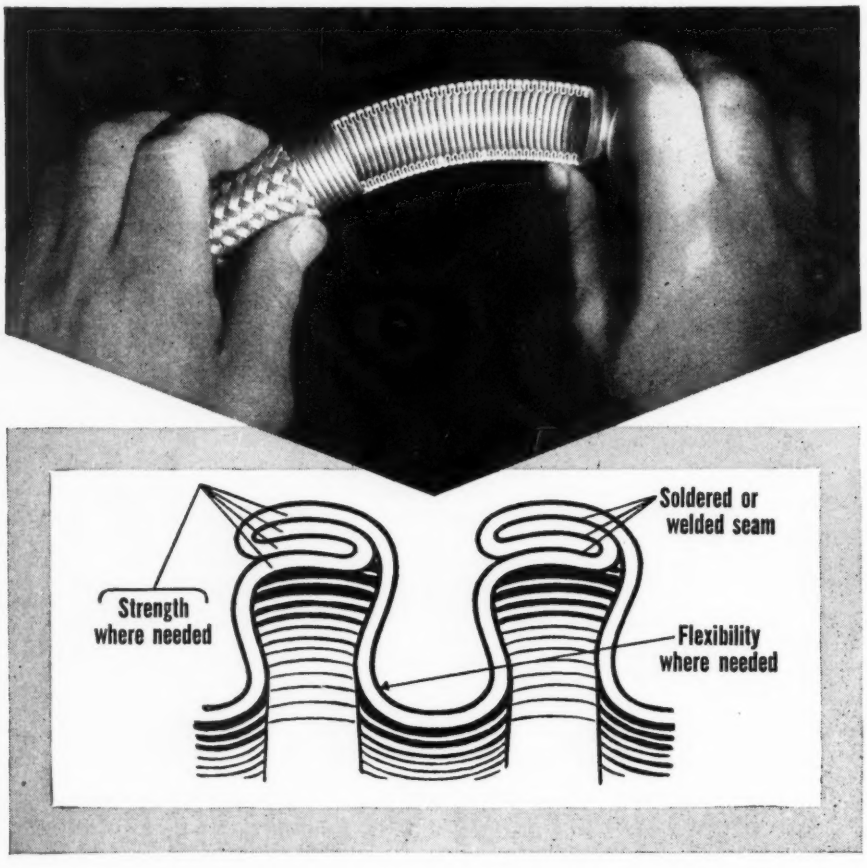
Ask your supplier to demonstrate the many features of Dart Unions.

DART
UNIONS

E. M. DART MFG. CO., PROVIDENCE 5, R. I.

When the going is ROUGH

Titeflex stands up



The drawing above illustrates exactly why Titeflex all-metal flexible tubing stands up under the most rugged conditions.

Note that there are *four* thicknesses of metal at the top of each convolution—right where the greatest wear is encountered.

Note that flexibility is achieved by wall construction without deforming or stretching the metal. There are no packed, sliding joints to wear out or decompose.

Note that the metal strips are soldered tightly together to prevent leakage of both gases and liquids.

Note that Titeflex tubing is *all metal*—it is unaffected by gas, oil or liquids . . . and withstands high temperatures. Yet it is fully flexible and holds up under excessive vibrations.

Your are invited to make full use of the Titeflex research laboratories and engineering service in solving your tubing problems. Write today for full information. Catalog on request.

Titeflex, Inc. 519 Frelinghuysen Ave., Newark 5, N.J.

Exclusive Manufacturers of Titeflex high quality products for more than 30 years

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Hill Acme Co.
Jones & Lamson Mch. Co.
Landis Mch. Co., Inc.
Modern Tool Works
Morse Twist Drill & Mch. Co.
National Acme Co.
Oster Manufacturing Co.
Pratt & Whitney Co.
Standard Tool Co.

Threading Opening

Eastern Mch. Screw Corp.
Errington Mechanical Laboratory
Geometric Tool Co.
Hill Acme Co.
Jones & Lamson Mch. Co.
Landis Mch. Co., Inc.
Modern Tool Works
National Acme Co.
Oster Manufacturing Co.

Thread Rolling

Hanson-Whitney Mch. Co.
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Carborundum Co.
Gardner Mch. Co.
Norton Co.
Raybestos-Manhattan, Inc., Manhattan-Rubber Div.
Simonds Abrasive Co.
Walls Sales Corp.

DIVIDING HEADS

See Index Centers.

DOWEL PINS

Allen Mfg. Co.
Baumbach, E. A., Mfg. Co.
Danly Mch. Specialties, Inc.
U. S. Tool Co., Inc.

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Universal Drafting Machine Co.

DRAWING BOARDS AND TABLES

Universal Drafting Machine Co.

DRAWING INSTRUMENTS

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Desmond-Stephan Mfg. Co.
Lee, K. O., & Son Co.
Norton Co.
Standard Tool Co.
Super Tool Co.

DRIFTS, DRILL

Armstrong Bros. Tool Co.
Standard Tool Co.

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Rehnberg-Jacobson Mfg. Co.

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Buffalo Forge Co.
Buhr Machine Tool Co.
Delta Mfg. Div., Rockwell Mfg. Co.
Errington Mechanical Laboratory
Ettco Tool Co.
Ex-Cell-O Corp.
Langelier Mfg. Co.
Moline Tool Co.
National Automatic Tool Co.
United States Drill Head Co.

DRILL SOCKETS

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Cleveland Twist Drill Co.
Greenfield Tap & Die Corp.
Morse Twist Drill & Mch. Co.
National Twist Drill & Tool Co.
Pratt & Whitney Co.
Standard Tool Co.
Union Twist Drill Co.

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DRILL STANDS

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Greenfield Tap & Die Corp.
Morse Twist Drill & Mch. Co.
National Twist Drill & Tool Co.
Standard Tool Co.
Union Twist Drill Co.

DRILLING MACHINES

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Avey Drilling Machine Co.
Baker Brothers, Inc.
Barnes Drill Co.
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Bodine Corp.
Bradford Machine Tool Co.
Buhr Machine Tool Co.
Consolidated Mch. Tool Corp.
Cross Co.
Grant Mfg. & Mch. Co.
Kingsbury Mch. Tool Corp.
Langelier Mfg. Co.
National Automatic Tool Co.

Bench

Ames, B. C., Co.
Atlas Press Co.
Avey Drilling Machine Co.
Buffalo Forge Co.
Canedy-Otto Mfg. Co.
Delta Mfg. Div. Rockwell Mfg. Co.
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Elgin Tool Wks., Inc.
Henry & Wright Mfg. Co.
Langelier Mfg. Co.
Leland-Gifford Co.

Photos courtesy
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Kalamazoo, Mich.
Cincinnati Planer Co.
Cincinnati, Ohio

LESS VIBRATION
REDUCES WEAR
LENGTHENS LIFE

RUTHMAN GUSHER
COOLANT PUMPS

The entire rotating assembly of every Ruthman Pump is electronically balanced, assuring alignment and vibrationless rigidity of the shaft. Thus vibration is cut to a minimum, wear is reduced, and a long trouble-free life for your Ruthman Gusher Coolant Pump is assured.

Illustrated on the left is a Hammond 6" Model VH-6 Abrasive Belt Grinder equipped with a Model 1-P3-1/10 HP Short Ruthman Gusher Pump. On the right is a Cincinnati Planer Company 64" Vertical Boring and Turning Mill equipped with a Model 11023-A Long Ruthman Gusher Coolant Pump. Follow the leading manufacturers of machine tools and equip your machines with Gusher Coolant Pumps.

Write for Catalog 10-K

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1807 READING RD. CINCINNATI, OHIO

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Production Machine Co.
Walker-Turner Co., Inc.

Boiler

Cincinnati Bickford Tool Co.
Foote-Burt Co.

Gang

Avey Drilling Machine Co.
Baker Brothers, Inc.
Barnes Drill Co.
Canedy-Otto Mfg. Co.
Cincinnati Bickford Tool Co.
Consolidated Mch. Tool Corp.
Cross Co.
Delta Mfg. Div. Rockwell Mfg. Co.
Edlund Machinery Co., Inc.
Foote-Burt Co.
Ingersoll Milling Mch. Co.
Langelier Mfg. Co.
Leland-Gifford Co.
Moline Tool Co.
National Automatic Tool Co.
Production Machine Co.
Producto Machine Co.

Horizontal Duplex

Avey Drilling Machine Co.
Baker Brothers, Inc.
Barnes Drill Co.
Barnes, W. F., & John, Co.
Bradford Machine Tool Co.
Consolidated Mch. Tool Corp.
Cross Co.
Davis & Thompson Co.
Edlund Machinery Co., Inc.
Kingsbury Mch. Tool Corp.
Langelier Mfg. Co.
National Automatic Tool Co.
Sellers, Wm., & Co., Inc.
Sundstrand Mch. Tool Co.

Inverted

Baker Brothers, Inc.
Barnes Drill Co.

Multiple Center Column Type

Barnes Drill Co.

Multiple Spindle

Avey Drilling Machine Co.
Baker Brothers, Inc.
Barnes Drill Co.
Barnes, W. F., & John, Co.
Baush Machine Tool Co.
Bradford Machine Tool Co.
Buffalo Forge Co.
Buhr Machine Tool Co.
Canedy-Otto Mfg. Co.
Cincinnati Bickford Tool Co.
Cross Co.
Delta Mfg. Div. Rockwell Mfg. Co.
Edlund Machinery Co., Inc.
Foote-Burt Co.
Greenlee Bros. & Co.
Henry & Wright Mfg. Co.
Ingersoll Milling Mch. Co.
Kingsbury Mch. Tool Corp.
Langelier Mfg. Co.
Leland-Gifford Co.
Moline Tool Co.
National Automatic Tool Co.
Pratt & Whitney Co.
Production Mch. Co.
Taylor & Fenn Co.

Radial

American Tool Wks. Co.
Canedy-Otto Mfg. Co.
Carlton Machine Tool Co.
Cincinnati Bickford Tool Co.
Foote-Burt Co.
Giddings & Lewis Mch. Tool Co.

Rail

See Drilling Machines, Gang.

Sensitive

Atlas Press Co.
Avey Drilling Machine Co.
Buffalo Forge Co.
Canedy-Otto Mfg. Co.
Delta Mfg. Div. Rockwell Mfg. Co.
Edlund Machinery Co., Inc.
Foote-Burt Co.
Henry & Wright Mfg. Co.
Langelier Mfg. Co.
Leland-Gifford Co.
Moline Tool Co.
National Automatic Tool Co.
Pratt & Whitney Co.
Production Mch. Co.
Producto Machine Co.
Ryerson, Joseph T., & Son, Inc.
Taylor & Fenn Co.

Upright

Atlas Press Co.
Avey Drilling Machine Co.
Baker Brothers, Inc.
Barnes Drill Co.
Barnes, W. F. & John, Co.
Buffalo Forge Co.
Canedy-Otto Mfg. Co.
Cincinnati Bickford Tool Co.
Consolidated Mch. Tool Corp.
Cross Co.
Davis & Thompson Co.
Delta Mfg. Div. Rockwell Mfg. Co.
Edlund Machinery Co., Inc.
Foote-Burt Co.
Ingersoll Milling Mch. Co.
Langelier Mfg. Co.
Leland-Gifford Co.
Moline Tool Co.
National Automatic Tool Co.
Production Machine Co.
Producto Machine Co.
Rehnberg-Jacobson Mfg. Co.
Ryerson, Joseph T., & Son, Inc.

Wall Radial

Canedy-Otto Mfg. Co.
Cleveland Punch & Shear Works Co.
Consolidated Mch. Tool Corp.

DRILLS

Center

Cleveland Twist Drill Co.
Gairing Tool Co.
Greenfield Tap & Die Corp.
Keo Cutter Co.
Morse Twist Drill & Mch. Co.
National Twist Drill & Tool Co.
Pratt & Whitney Co.
Standard Tool Co.
Union Twist Drill Co.
Warner & Swasey Co.

Core

Carboloy Co., Inc.
Ex-Cell-O Corp.
Firth-Sterling Steel & Carbide Corp.
Gairing Tool Co.
Haynes Stellite Co.
Morse Twist Drill & Mch. Co.
National Twist Drill & Tool Co.
Standard Tool Co.
Super Tool Co.
Union Twist Drill Co.

Deep Hole

Connor Tool & Cutter Co.

Portable Electric

Ryerson, Joseph T., & Son, Inc.

Portable Pneumatic

Ingersoll-Rand Co.
Rotor Tool Co.

Ratchet

Armstrong Bros. Tool Co.
Cleveland Twist Drill Co.
Greenfield Tap & Die Corp.
Morse Twist Drill & Mch. Co.
National Twist Drill & Tool Co.
Pratt & Whitney Co.
Standard Tool Co.
Union Twist Drill Co.

Twist

Carboloy Co., Inc.
Cleveland Twist Drill Co.
Firth-Sterling Steel & Carbide Corp.
Greenfield Tap & Die Corp.
Morse Twist Drill & Mch. Co.
National Twist Drill & Tool Co.
Pratt & Whitney Co.
Standard Tool Co.
Super Tool Co.
Union Twist Drill Co.

Wire

Greenfield Tap & Die Corp.
Morse Twist Drill & Mch. Co.
National Twist Drill & Tool Co.
Standard Tool Co.
Union Twist Drill Co.

DUPLICATORS

Rockford Machine Tool Co.

ELECTRICAL EQUIPMENT

Westinghouse Electric Corp.

ELEVATORS

Otis Electric Co.

EMERY WHEELS

See Grinding Wheels.

EMERY WHEEL DRESSERS

See Dressers, Grinding Wheel.

ENGRAVING MACHINES

Gorton, George, Mch. Co.

EXTRACTORS, Screw

Greenfield Tap & Die Corp.
Morse Twist Drill & Mch. Co.

FACING MACHINE

Ex-Cell-O Corp.

FANS, Exhaust, Electric Ventilating

Buffalo Forge Co.

FEEDS FOR PRESSES, Automatic

Cleveland Punch & Shear Works Co.
Peck, Stow & Wilcox Co.
S. & S. Machine Wks.
U. S. Tool Co., Inc.
V & O Press Co.

FILES

Simonds Saw & Steel Co.

Machine

Oliver Instrument Co.

Rotary

Haskins, R. G., Co.
Pratt & Whitney Co.
Strand, N. A., & Co.

FILING MACHINES, Dies, Etc.

Ames, B. C., Co.
Cochrane-Bly Co.
DoAll Co.
Grob Brothers
Oliver Instrument Co.

FILTERS, COOLANT AND OIL

Frantz, S. G., Co., Inc.
Marvel Engrg. Co.

FLEXIBLE COUPLINGS

See Couplings, Flexible.

FLEXIBLE SHAFT EQUIPMENT

Haskins, R. G., Co.
Pratt & Whitney Co.
Strand, N. A., & Co.
Walker-Turner Co., Inc.

FLOORING MATERIAL

Monroe Co., Inc.

FORGINGS (Upsetting) MCHS.

Ajax Manufacturing Co.
Baldwin Locomotive Works
Hill Acme Co.
National Machinery Co.

FORGINGS

Drop

Bethlehem Steel Co.
Williams, J. H., & Co.

Hollow Bored

American Hollow Boring Co.
Bethlehem Steel Co.

Iron and Steel

Bethlehem Steel Co.
Jones & Laughlin Steel Corp.
Morgan Engineering Co.

Manganese, Bronze, Etc.

Cram Brass & Iron Foundries Div.

Upset

Bethlehem Steel Co.
Williams, J. H., & Co.

FORMING AND BENDING MCHS.

Baldwin Locomotive Works
Bethlehem Steel Co.
Chambersburg Engineering Co.
Cincinnati Shaper Co.
Cleveland Punch & Shear Works Co.
Consolidated Mch. Tool Corp.
Hannifin Corp.
O'Neil-Irwin Mfg. Co.
Yoder Co.

FORMING AND STAMPING MCHS.

Chambersburg Engineering Co.
Cincinnati Shaper Co.
U. S. Tool Co., Inc.

FORMING TOOLS or Tool Blanks

Brown & Sharpe Mfg. Co.
Firth-Sterling Steel & Carbide Corp.
National Broach & Mch. Co.
Pratt & Whitney Co.

FRAMES, Machinery, Welded

Mahon, R. C., Co.

FRICTION MATERIAL
(Brake Lining and Clutch Facing)

Raybestos-Manhattan, Inc.,
Manhattan-Rubber Div.

FURNACES

Hardness

Leeds & Northrup Co.

Heat-Treating

Cooley Electric Mfg. Co.
Leeds & Northrup Co.
Westinghouse Electric Corp.

FURNITURE, Shop

Lee, K. O., & Son Co.
Standard Pressed Steel Co.

GAGE BLOCKS

Johansson Div., Ford Motor Co.
Pratt & Whitney Co.
Scherr, George, Co., Inc.

GAGES, Comparator

Federal Products Corp.
Jones & Lamson Machine Co.
Pratt & Whitney Co.
Scherr, George, Co., Inc.
Sheffield Corp.
Woodworth, N. A., Co.

Depth

Brown & Sharpe Mfg. Co.
Federal Products Corp.
Scherr, George Co., Inc.
Standard Gage Co., Inc.
Starrett, L. S., Co.

Dial

Ames, B. C., Co.
Bristol Co.
Brown & Sharpe Mfg. Co.
Federal Products Corp.
Scherr, George Co., Inc.
Sheffield Corp.
Standard Gage Co., Inc.
Starrett, L. S., Co.

Electric

Pratt & Whitney Co.

Height

Brown & Sharpe Mfg. Co.
Scherr, George, Co., Inc.
Standard Gage Co.
Starrett, L. S., Co.

Plug, Ring and Snap

Axelson Mfg. Co.
Brown & Sharpe Mfg. Co.
Carboloy Co., Inc.
Ex-Cell-O Corp.
Federal Products Corp.
Firth-Sterling Steel & Carbide Corp.
Greenfield Tap & Die Corp.
Haynes Stellite Co.
Kennametal, Inc.
Merz Engineering Co.
Morse Twist Drill & Machine Co.
Pratt & Whitney Co.
Scherr, George, Co., Inc.
Sheffield Corp.
Standard Gage Co., Inc.
Starrett, L. S., Co.
Woodworth, N. A., Co.

Surface

Brown & Sharpe Mfg. Co.
Columbus Die, Tool & Mch. Co.
Standard Gage Co., Inc.
Starrett, L. S., Co.

Taper

Brown & Sharpe Mfg. Co.
Johansson Div., Ford Motor Co.
Pratt & Whitney Co.
Sheffield Corp.
Standard Gage Co., Inc.
Starrett, L. S., Co.

Thread

Axelson Mfg. Co.
Bath, John, & Co., Inc.
Brown & Sharpe Mfg. Co.
Detroit Tap & Tool Co.
Federal Products Corp.
Greenfield Tap & Die Corp.
Hanson-Whitney Machine Co.
Jones & Lamson Machine Co.
Merz Engineering Co.
Pratt & Whitney Co.
Sheffield Corp.
Sossner, Inc.
Starrett, L. S., Co.
Woodworth, N. A., Co.

GASKETS

Garlock Packing Co.
Raybestos-Manhattan, Inc.,

GEAR BLANKS, Non-Metallic

Braun Gear Co.
Ganschow Gear Co.
Westinghouse Electric Corp.

GEAR BURNISHING MACHINES

Fellows Gear Shaper Co.

GEAR CHECKING INSTRUMENTS AND EQUIPMENT

Brown & Sharpe Mfg. Co.
Fellows Gear Shaper Co.
Gleason Works
Michigan Tool Co.
National Broach & Mch. Co.
Pratt & Whitney Co.
Scherr, George, Co., Inc.

GEAR CUTTING MACHINES

Bevel Gears (Generator)

Bilgram Gear & Machine Wks.
Gleason Works

Bevel Gears (Rotary Cutter)

Newark Gear Cutting Machine Co.
Producto Machine Co.
Waltham Mch. Wks.

Bevel Gears, Spiral

Gleason Works

Spur and Helical Gears (Hobbing)

Barber-Colman Co.
Newark Gear Cutting Machine Co.
New Jersey Gear & Mfg Co.

Spur and Helical Gears (Shaper or Planer Type)

Farrel-Birmingham Co., Inc.
Fellows Gear Shaper Co.
National Tool Co.

Spur and Helical Gears (Shear-speed Type)

Michigan Tool Co.

Worm and Worm Wheels

Barber-Colman Co.
Fellows Gear Shaper Co.
(Straight and Hourglass Type)
New Jersey Gear & Mfg. Co.
Producto Machine Co.

GEAR FINISHING MACHINES

Fellows Gear Shaper Co.
Michigan Tool Co.

GEAR GRINDING MACHINES

Fitchburg Grinding Mch. Corp.
Gleason Works
Pratt & Whitney Co.

COMMERCIAL TOOL HARDENING AND HEAT TREATING

Strictly Modern Equipment, Backed by the Skill and Judgment of 30 Years Experience. Also, We Sell "Heat-Easy" Compound for Pack Hardening High Speed and High Carbon—High Chrome Steels.

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PATENTED CUTTING OFF TOOL HOLDERS
PATENTED CUTTING OFF BLADES

ONLY the PATENTED construction of LUERS cutting off BLADES permits normal expansion of bursting chips — MEANS MAXIMUM CUTTING EFFICIENCY.

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Gleason Works

GEAR LAPPING MACHINES
Fellows Gear Shaper Co.
Gleason Works
Michigan Tool Co.
National Broach & Mch. Co.

GEAR MOTORS
See Speed Reducers.

GEAR SHAVING MACHINES
Fellows Gear Shaper Co.
National Broach & Mch. Co.

GEAR TESTING MACHINERY
Baldwin Locomotive Works
Brown& &Sharpe Mfg. Co.
Farrel-Birmingham Co., Inc.
Fellows Gear Shaper Co.
National Tool Co.
Newark Gear Cutting Machine Co.
Pratt & Whitney Co.
Scherr, George, Co., Inc.

GEARS

Cut
Automotive Gear Works, Inc.
Baush Machine Tool Co.
Beaver Gear Works, Inc.
Bethlehem Steel Co.
Bilgram Gear & Machine Works
Boston Gear Works, Inc.
Brad Foote Gear Works
Braun Gear Co.
Cincinnati Gear Co.
Cleveland Worm & Gear Co.
Cone Drive Div., Michigan Tool Co.
DeLaval Steam Turbine Co.
Detroit Bevel Gear Co.
Diefendorf Gear Corp.
Earle Gear & Mch. Co.
Eberhardt-Denver Co.
Fairfield Mfg. Co.
Farrel-Birmingham Co., Inc.
Fellows Gear Shaper Co.
Ganschow Gear Co.
Gear Specialties
General Electric Co.
Gleason Works
Grant Gear Wks., Inc.
Hartford Special Mchy. Co.
Husted Gear Co.
Massachusetts Gear & Tool Co.
Meisel Press Mfg. Co.
Michigan Tool Co.
Newark Gear Cutting Machine Co.
New Jersey Gear & Mfg. Co.
Ohio Gear Co.
Perkins Mch. & Gear Co.
Philadelphia Gear Works
Pittsburgh Gear & Machine Co.
Sier-Bath Gear & Pump Co., Inc.
Stahl Gear & Machine Co.
Taylor Mch. Co.
Technical Products Co.
Westinghouse Electric Corp.

Molded
Philadelphia Gear Works
Westinghouse Electric Corp.

Rawhide and Non-Metallic
Boston Gear Works, Inc.
Braun Gear Co.
Cincinnati Gear Co.
Diefendorf Gear Corp.
Earle Gear & Mch. Co.
Ganschow Gear Co.
General Electric Co.
Grant Gear Works, Inc.
Hartford Special Mchy. Co.
Massachusetts Gear & Tool Co.
Meisel Press Mfg. Co.
Philadelphia Gear Works
Pittsburgh Gear & Mch. Co.
Stahl Gear & Machine Co.
Taylor Mch. Co.
Westinghouse Electric Corp.

GENERATORS, ELECTRIC
Lincoln Electric Co.
Reliance Electric & Mfg. Co.
Westinghouse Electric Corp.

GOGGLES
American Optical Co.

GRADUATING MACHINES
Gorton, George, Mch. Co.
Noble & Westbrook Mfg. Co.

GREASE
Cities Service Oil Co.
Gulf Oil Corp.
Standard Oil Co. (Indiana)
Sun Oil Co.
Texas Co.
Tide Water Associated Oil Co.

GRINDERS

Carbide Tool
Oliver Instrument Co.
Sundstrand Mch. Tool Co.

Die and Mold
Consolidated Mch. Tool Corp.
Haskins, R. G., Co.
Pratt & Whitney Co.

Oilstone, for Woodworking Tools
Mummert-Dixon Co.

Pneumatic
Cleco Pneumatic Tool Div.
Ingersoll-Rand Co.
Madison-Kipp Corp.
Rotor Tool Co.

Portable Electric and Toolpost
Haskins, R. G., Co.

GRINDING MACHINES

Abrasive Belt
Delta Mfg. Div. Rockwell Mfg. Co.
DoAll Co.
Hill Acme Co.
Mattison Mach. Wks.
Porter-Cable Machine Co.
Production Machine Co.
Walker-Turner Co., Inc.
Walls Sales Corp.

Bench
Atlas Press Co.
Delta Mfg. Div. Rockwell Mfg. Co.
Hardinge Brothers, Inc.
Rivett Lathe & Grinder, Inc.
Ryerson, Joseph T., & Son, Inc.
Walker-Turner Co., Inc.

Broach
Gear Grinding Machine Co.

Camshaft
Landis Tool Co.
Norton Co.

Carbide Tool
Carboloy Co., Inc.
Ex-Cell-O Corp.
Oliver Instrument Co.

Centerless
Cincinnati Grinders, Inc.
Heald Machine Co.
Landis Tool Co.

Chaser or Die
Eastern Mch. Screw Corp.
Fitchburg Grinding Mch. Corp.
Geometric Tool Co.
Landis Machine Co., Inc.

Chucking
Bryant Chucking Grinder Co.
Fitchburg Grinding Mch. Corp.

Crankshaft
Landis Tool Co.
Norton Co.

Cylinder
Bryant Chucking Grinder Co.
Heald Machine Co.
Landis Tool Co.

Cylindrical
Arter Grinding Machine Co.
Brown & Sharpe Mfg. Co.
Cincinnati Grinders, Inc.
Fitchburg Grinding Mch. Corp.
Landis Tool Co.
Modern Tool Wks.
(Cons. Mch. Tool Corp.)
Morse Twist Drill & Mch. Co.
Norton Co.
Pratt & Whitney Co.
Rivett Lathe & Grinder, Inc.
Thompson Grinder Co.

Disc
Besly, Chas. H., & Co.
Gardner Machine Co.
Porter-Cable Machine Co.
Production Mch. Co.

Drill
Delta Mfg. Div. Rockwell Mfg. Co.
Gallmeyer & Livingston Co.
Oliver Instrument Co.
Union Twist Drill Co.

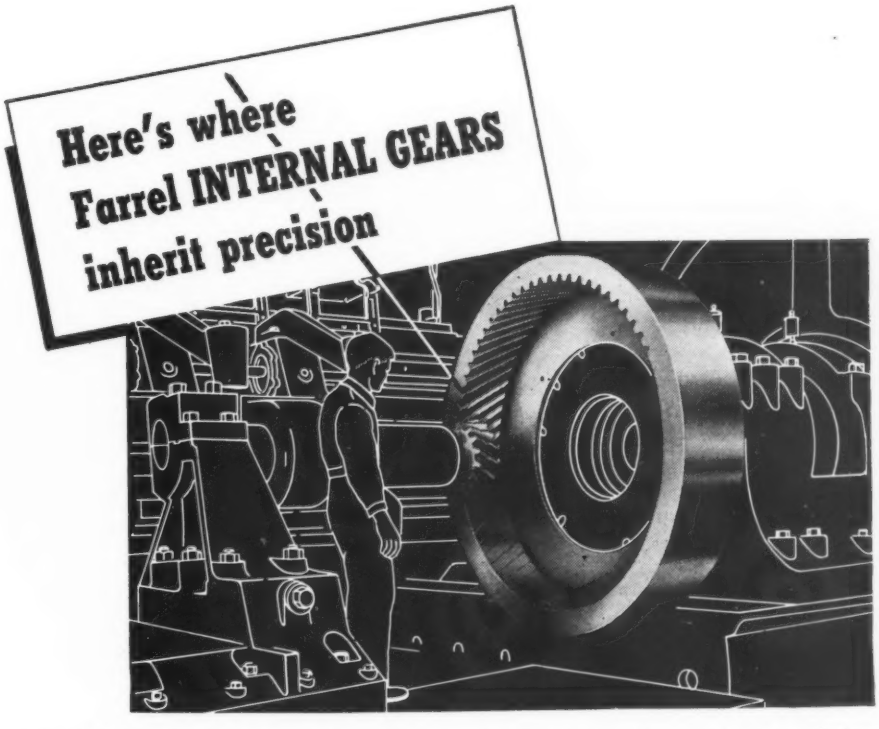
Face
Abrasive Mch. Tool Co.
Oliver Instrument Co.

Flexible Shaft
See Flexible Shaft Equipment.

Gear Tooth
Gear Grinding Machine Co.
National Tool Co.
Pratt & Whitney Co.

For Sharpening Turning and Planing Tools
Delta Mfg. Div. Rockwell Mfg. Co.
Oliver Instrument Co.
Production Mch. Co.
Walker, O. S., Co., Inc.
Waltham Mch. Wks.

Internal
Bryant Chucking Grinder Co.
Heald Machine Co.
Landis Tool Co.
Modern Tool Wks.
(Cons. Mch. Tool Corp.)



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The initial precision built into this Farrel machine plus the inherent accuracy of its operating principle — "precision generation" — gives the gears accurate tooth contour and tooth spacing. Because of this you can be sure that when you buy internal gears from Farrel, they will operate smoothly, quietly and efficiently over a long service life.

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Jig

Moore Special Tool Co., Inc.

Knife and Shear Blade

Hill Acme Co.

Piston Ring

Arter Grinding Machine Co.
Heald Machine Co.

Profile

Boyar-Schultz Corp.

Pulleys

Abrasive Mch. Tool Co.

Radial, Ball Race, Etc.

Landis Tool Co.

Radius, Link

Consolidated Mch. Tool Corp.
Sundstrand Mch. Tool Co.

Ring Wheel

Besly, Chas. H., & Co.
Gardner Machine Co.

Roll

Farrel-Birmingham Co., Inc.
Landis Tool Co.
Norton Co.

Spline

Fitchburg Grinding Machine Corp.
Gear Grinding Machine Co.

Surface

Abrasive Mch. Tool Co.
Arter Grinding Machine Co.
Blanchard Mch. Co.
Brown & Sharpe Mfg. Co.
DoAll Co.
Foote-Burt Co.
Gallmeyer & Livingston Co.
Gardner Mch. Co.
Heald Machine Co.
Hill Acme Co.
Leach, H., Machinery Co.
Mattison Machine Works
Norton Co.
Pratt & Whitney Co.
Producto Machine Co.
Robot Machinery Co.
Thompson Grinder Co.
Walker, O. S., Co., Inc.

Tap

Blake, Edward, Co.
Ex-Cell-O Corp.
Jones & Lamson Mch. Co.

Thread

Ex-Cell-O Corp.
Jones & Lamson Mch. Co.
Landis Machine Co., Inc.

Universal, for Sharpening Cutters, Reamers, Hobs, Etc.

Barber-Colman Co.
Brown & Sharpe Mfg. Co.
Cincinnati Milling Mch. Co.
DoAll Co.
Fellows Gear Shaper Co.
(Helical Gear Shaper Cutters)
Fitchburg Grinding Mch. Corp.
Gallmeyer & Livingston Co.
Ingersoll Milling Mch. Co.
Landis Tool Co.
LeBlond, R. K., Mch. Tool Co.
Lee, K. O., & Son Co.
Norton Co.
Oliver Instrument Co.
Pratt & Whitney Co.
Thompson Grinder Co.
Union Twist Drill Co.

Worm

Gear Grinding Machine Co.
Jones & Lamson Mch. Co.
Pratt & Whitney Co.

GRINDING WHEELS

Bay State Abrasive Co.
Besly, Chas. H., & Co.
Blanchard Mch. Co.
Carborundum Co.
Electro Refractories & Alloy Corp.
Norton Co.
Raybestos-Manhattan, Inc., Manhattan-Rubber Div.
Simonds Abrasive Co.
Vitrified Wheel Co.

GROOVING TOOL, INTERNAL

Waldes Kohinoor, Inc.

HAMMERS, Drop

Bliss, E. W., Co.
Chambersburg Engineering Co.
Erie Foundry Co.
Morgan Engineering Co.

Forging Air

Lobdell Co.

Pneumatic

Chambersburg Engineering Co.
Cleco Pneumatic Tool Div.
Madison-Kipp Corp.

Power

Lobdell Co.
Quickwork-Whiting Div. of Whiting Corp.

Soft

Chambersburg Engineering Co.
S. & H. Soft Hammer Products Co.

Steam

Chambersburg Engineering Co.
Erie Foundry Co.

HANGERS, Shaft

Boston Gear Works, Inc.
Hill Acme Co.
S K F Industries, Inc.
Standard Pressed Steel Co.

HARDENING EQUIPMENT, INDUCTION

Lepel High Frequency Laboratories, Inc.
Ohio Crankshaft Co.

HARDNESS TESTING INSTRUMENTS
Shore Instrument & Mfg. Co.
Wilson Mechanical Instrument Co., Inc.

HEADING MACHINES
National Machinery Co.

HEAT TREATMENT OF METALS
Bennett Metal Treating Co.
Ohio Gear Co.
Pittsburgh Gear Mch. Co.
Selas Corp. of America

HOBBING MACHINES
See Gear Cutting Machines, Helical and Spur (Hob), and Gear Cutting Machines, Worm and Worm Wheels.

HOBS
Barber-Colman Co.
Brown & Sharpe Mfg. Co.
Michigan Tool Co.
National Twist Drill & Tool Co.
New Jersey Gear & Mfg. Co.
Sossner, Inc.
Union Twist Drill Co.

HOIST HOOKS
Bethlehem Steel Co.
Williams, J. H., & Co.

HOISTING AND CONVEYING MACHINERY
Shepard Niles Crane & Hoist Corp.

HOISTS, Air
Hanna Engineering Works
Ingersoll-Rand Co.

Chain, Etc.
Ryerson, Joseph T., & Son, Inc.
Union Mfg. Co.

Electric
Philadelphia Gear Works
Shepard Niles Crane & Hoist Corp.
Union Mfg. Co.

HONES
Carborundum Co.
Micromatic Hone Corp.
Moline Tool Co.
Sunnen Products Co.

HONING MACHINES, Internal (Cylinder)
Barnes Drill Co.
Barnes, W. F. and John, Co.
Micromatic Hone Corp.
Moline Tool Co.
Sunnen Products Co.

HONING MACHINES, External
Barnes Drill Co.
Micromatic Hone Corp.

Hose, Leather, Rubber, Metallic, Etc.
American Metal Hose Div., American Brass Co.
Cleco Pneumatic Tool Div.
Raybestos-Manhattan, Inc., Manhattan-Rubber Div.

HYDRAULIC MACHINERY, Tools and Equipment
Baldwin Locomotive Works
Barnes, John S., Corp.
Bethlehem Steel Co.
Birdsboro Steel Fdry. & Mch. Co.
Bliss, E. W., Co.
Chambersburg Engineering Co.
Cross Co.
Denison Engineering Co.
Elmes Engineering Works
Farquhar, A. B., Co.
Hannifin Corp.
Hydropress Co., Inc.
Lake Erie Engineering Corp.
Oilgear Co.
Rockford Machine Tool Co.
Sundstrand Mch. Tool Co.

HYDRAULIC POWER UNITS OR TOOL HEADS
Barnes Drill Co.
Barnes, John S., Corp.
Barnes, W. F. and John, Co.
Ex-Cell-O Corp.
Hannifin Corp.

HYDRAULIC, Tool Head or Power Unit
Barnes Drill Co.
LeMaire Tool & Mfg. Co.
National Automatic Tool Co.
New Britain-Gridley Mch. Div. New Britain Machine Co.

INDEX CENTERS
Abrasive Mch. Tool Co.
Brown & Sharpe Mfg. Co.
Cochrane-Bly Co.
Kempsmith Mch. Co.

INDEXING and Spacing Fixtures
Hartford Special Mchry. Co.

INDICATOR, Dial
Ames, B. C., Co.
Browne & Sharpe Mfg. Co.
Federal Products Corp.
Standard Gage Co., Inc.
Starrett, L. S., Co.

Speed
Bristol Co.
Brown & Sharpe Mfg. Co.
Starrett, L. S., Co.
Veeder-Root, Inc.

Test
Browne & Sharpe Mfg. Co.
Federal Products Corp.
Standard Gage Co., Inc.
Starrett, L. S., Co.

INDUCTION HEATING EQUIPMENT
Lepel High Frequency Laboratories, Inc.
Ohio Crankshaft Co.

INTENSIFIERS, Hydraulic
Baldwin Locomotive Works
Elmes Engineering Works
Farquhar, A. B., Co.
Morgan Engineering Co.

JACKS, Planer
Armstrong Bros. Tool Co.

JIG BORER
See Boring Machines, Jig.

JIGS AND FIXTURES
Columbus Die, Tool & Mch. Co.
Ex-Cell-O Corp.
Hartford Special Mchry. Co.
Ingersoll Milling Mch. Co.
Logansport Machine Co., Inc.
Merz Engineering Co.
Sossner, Inc.
Sundstrand Mch. Tool Co.

KEYSEATERS
Baker Bros., Inc.
Consolidated Mch. Tool Corp.
Davis Keyseater Co.
Lapointe Machine Tool Co.

KNURL HOLDERS
Brown & Sharpe Mfg. Co.
Graham Mfg. Co., Inc.
Pratt & Whitney Co.

KNURLING TOOLS
Armstrong Bros. Tool Co.
Fakes, Joseph B., & Co.
Graham Mfg. Co., Inc.
Pratt & Whitney Co.
Williams, J. H., & Co.

LAPPING MACHINES
Cincinnati Grinders, Inc.
Ex-Cell-O Corp.
Fellows Gear Shaper Co.
Norton Co.
Spitfire Tools, Inc.

LATHE ATTACHMENTS
American Tool Wks. Co.
Atlas Press Co.
Bradford Machine Tool Co.
Gisholt Mch. Co.
Hendey Machine Co.
Jones & Lamson Mch. Co.
LeBlond, R. K., Mch. Tool Co.
Lodge & Shipley Co.
Monarch Mch. Tool Co.
Newton Mfg. Co.
Pratt & Whitney Co.
Reed-Prentice Corp.
Rivett Lathe & Grinder, Inc.
Seneca Falls Mch. Co.
South Bend Lathe Wks., Inc.
Springfield Mch. Tool Co.
Stark Tool Co.
Sundstrand Mch. Tool Co.
Warner & Swasey Co.

LATHE AND GRINDING DOGS
Armstrong Bros. Tool Co.
Williams, J. H., & Co.

LATHES

Automatic
Baird Machine Co.
Cross Co.
Gisholt Mch. Co.
Goss & DeLeeuw Mch. Co.
Jones & Lamson Mch. Co.
LeBlond, R. K., Mch. Tool Co.
Lodge & Shipley Co.
Monarch Mch. Tool Co.
National Acme Co.
New Britain-Gridley Mch. Div., New Britain Machine Co.
Porter-Cable Machine Co.
Potter & Johnston Mch. Co.
Pratt & Whitney Co.
Reed-Prentice Corp.
Seneca Falls Mch. Co.
Sundstrand Mch. Tool Co.

Axles and Shaft
Consolidated Mch. Tool Corp.
Cross Co.
LeBlond, R. K., Mch. Tool Co.
Lodge & Shipley Co.
Seneca Falls Mch. Co.
Sundstrand Mch. Tool Co.

Bench
Ames, B. C., Co.
Atlas Press Co.
Elgin Tool Wks., Inc.
Hardinge Brothers, Inc.
LeBlond, R. K., Mch. Tool Co.
Pratt & Whitney Co.
Rivett Lathe & Grinder, Inc.
Seneca Falls Mch. Co.
Sheldon Mch. Co.
South Bend Lathe Wks.
Stark Tool Co.

Boring
Gisholt Mch. Co.
LeBlond, R. K., Mch. Tool Co.
Lodge & Shipley Co.

Brass Workers
Bardons & Oliver, Inc.
Gisholt Mch. Co.
Seneca Falls Mch. Co.
Springfield Mch. Tool Co.
Warner & Swasey Co.

Crankshaft
Consolidated Mch. Tool Corp.
Cross Co.
LeBlond, R. K., Mch. Tool Co.
Sundstrand Mch. Tool Co.

Double-End
Consolidated Mch. Tool Corp.
LeBlond, R. K., Mch. Tool Co.
Sundstrand Mch. Tool Co.

Engine and Toolroom
American Tool Wks. Co.
Atlas Press Co.
Axelson Manufacturing Co.
Bradford Machine Tool Co.
Consolidated Mch. Tool Corp.
DoAll Co.
Hendey Machine Co.
LeBlond, R. K., Mch. Tool Co.
Lehmann Machine Co.
Lodge & Shipley Co.
Logan Engineering Co.
Monarch Mch. Tool Co.
Morey Mchry. Co., Inc.
Pratt & Whitney Co.
Reed-Prentice Corp.
Rivett Lathe & Grinder, Inc.
Seneca Falls Mch. Co.
Sheldon Mch. Co.
Sidney Machine Tool Co.
Simmons Machine Tool Corp.
South Bend Lathe Wks.
Springfield Mch. Tool Co.

Extension Bed and Gap
Gisholt Mch. Co.
LeBlond, R. K., Mch. Tool Co.
Lodge & Shipley Co.
Seneca Falls Mch. Co.
South Bend Lathe Wks.
Warner & Swasey Co.

Gun
Consolidated Mch. Tool Corp.
LeBlond, R. K., Mch. Tool Co.
Lodge & Shipley Co.
Seneca Falls Mch. Co.
Springfield Mch. Tool Co.

Manufacturing Type
Lipe-Rollway Corporation
Lodge & Shipley Co.

Spinning
See Chucking Machines.

Toolroom
See Lathes, Engine and Toolroom.

Turret
Bardons & Oliver, Inc.
Brown & Sharpe Mfg. Co.
Bullard Company
Gisholt Mch. Co.
Hardinge Brothers, Inc. (Bench or Cabinet Mounting)
Jones & Lamson Mch. Co.
LeBlond, R. K., Mch. Tool Co.
Morey Mchry. Co., Inc.
National Acme Co.
Oster Mfg. Co.
Potter & Johnston Mch. Co.
Production Machine Co.
Rivett Lathe & Grinder, Inc.
Simmons Machine Tool Corp.
South Bend Lathe Wks., Inc.
Springfield Mch. Tool Co.
Stark Tool Co.
Warner & Swasey Co.

Turret Automatic
Potter & Johnston Mch. Co.

Vertical Turret
Bullard Company

LEVELS
Pratt & Whitney Co.
Starrett, L. S., Co.
Universal Boring Mch. Co.

LUBRICANTS, Including Extreme Pressure (EP) Machinery Lubricants
Cities Service Oil Co.
Gulf Oil Corp.
Sinclair Refining Co.
Standard Oil Co. (Indiana)
Stuart, D. A., Oil Co., Ltd.
Sun Oil Co.
Texas Co.
Tide Water Associated Oil Co.

LUBRICATING SYSTEMS
Madison-Kipp Corp.
Rivett Lathe & Grinder, Inc.

MACHINISTS' SMALL TOOLS
See Calipers, Hammers, Wrenches, Drills, Taps, Etc.

MANDRELS
See Arbors and Mandrels.

MARKING MACHINES AND DEVICES
Colonial Broach Co.
Noble & Westbrook Mfg. Co.
Sossner, Inc.

MEASURING MACHINES AND INSTRUMENTS, PRECISION
Federal Products Corp.
Hanson-Whitney Mch. Co.
Norma-Hoffmann Bearings Corp.
Pratt & Whitney Co.
Scherr, George, Co., Inc.

METALS, Bearing
See Bearings, Bronze, Babbitt, Etc. and Bushings, Brass, Bronze, Etc.

METALS, Perforated
Chicago Perforating Co.

METERS
See Recording Instruments.

MICROMETERS
Bath, John, & Co., Inc.
Brown & Sharpe Mfg. Co.
Davis & Thompson Co.
Pratt & Whitney Co.
Scherr, George, Co., Inc.
Starrett, L. S., Co.

MICROSCOPES, Toolmakers
Scherr, George, Co., Inc.

MILLING ATTACHMENTS
Brown & Sharpe Mfg. Co.
Cincinnati Milling Machine Co.
Consolidated Mch. Tool Corp.
Elgin Tool Wks., Inc.
Ingersoll Milling Mch. Co.
Kearney & Trecker Corp.
Kempsmith Mch. Co.
Porter Cable Machine Co.
Reed-Prentice Corp.
Rivett Lathe & Grinder, Inc.
Sundstrand Mch. Tool Co.
Van Norman Co.

MILLING MACHINES

Automatic
Cincinnati Milling Machine Co.
Consolidated Mch. Tool Corp.
Cross Co.
Ingersoll Milling Mch. Co.
Jones & Lamson Mch. Co.
Kearney & Trecker Corp.
Sundstrand Mch. Tool Co.
U. S. Tool Company, Inc.

Bench
Ames, B. C., Co.
Atlas Press Co.
Burke Machine Tool Co.
Hardinge Brothers, Inc. (Bench or Pedestal Type)
Pratt & Whitney Tool Co.
Stark Tool Co.

Circular Continuous
Consolidated Mch. Tool Corp.
Cross Co.
Davis & Thompson Co.
Ingersoll Milling Mch. Co.
Kearney & Trecker Corp.
Sundstrand Mch. Tool Co.

Die Sinking
See Die Sinking Machines.

Duplex
Cincinnati Milling Machine Co.
Consolidated Mch. Tool Corp.
Cross Co.
Ingersoll Milling Mch. Co.
Kearney & Trecker Corp.
Taylor & Fenn Co.

Hand
Burke Machine Tool Co.
Sundstrand Mch. Tool Co.
Van Norman Co.

Horizontal, Plain and Universal
Brown & Sharpe Mfg. Co.
Cincinnati Milling Machine Co.
Cochrane-Bly Co.
Consolidated Mch. Tool Corp.
Cross Co.
DoAll Co.
Gorton, George, Mch. Co.
Ingersoll Milling Mch. Co.
Kearney & Trecker Corp.
Kempsmith Mch. Co.
Producto Machine Co.
Sidney Machine Tool Co.
Simmons Machine Tool Corp.
Sundstrand Mch. Tool Co.
Van Norman Mch. Tool Co.

Lincoln Type
Brown & Sharpe Mfg. Co.
Sundstrand Mch. Tool Co.

Planer Type
Cincinnati Planer Co.
Consolidated Mch. Tool Corp.
Davis & Thompson Co.
Ingersoll Milling Mch. Co.
Kearney & Trecker Corp.
Stokerunit Corp.

Ram Type, Universal
Van Norman Co.

Vertical
Brown & Sharpe Mfg. Co.
Cincinnati Milling Machine Co.
Consolidated Mch. Tool Corp.
Cross Co.
DoAll Co.
Gorton, George, Mch. Co.
Ingersoll Milling Mch. Co.
Kearney & Trecker Corp.
Pratt & Whitney Co.
Reed-Prentice Corp.
Sidney Machine Tool Co.
Sommer & Adams Co.
Sundstrand Mch. Tool Co.
Taylor & Fenn Co.

MODEL AND EXPERIMENTAL WORK
See Special Machinery Tools.

MOLD AND DIE COPYING MACHINES
Gorton, George, Mch. Co.

MOLDING MACHINES, Plastic Products
Reed-Prentice Corp.

MOLYBDENUM
Climax Molybdenum Co.
Molybdenum Corp. of America

MOTORS, Electric
Lincoln Electric Co.
Reliance Electric & Engrg. Co.
Star Electric Motor Co.
Westinghouse Electric Corp.

MOUNTINGS, RUBBER, JOINTS AND COUPLINGS
Lord Manufacturing Co.
Raybestos-Manhattan, Inc., Manhattan Rubber Div.

MULTIPLE-SLIDE FORMING MACHINES
Baird Machine Co.
U. S. Tool Co., Inc.

NAME PLATES
Noble & Westbrook Mfg. Co.

NIBBLING MACHINES
Campbell, Andrew C., Div., American Chain & Cable Co., Inc.
Gray Machine Co.

Nickel
International Nickel Co.

NIPPLE THREADING MACHINERY
Landis Mch. Co., Inc.
Oster Manufacturing Co.

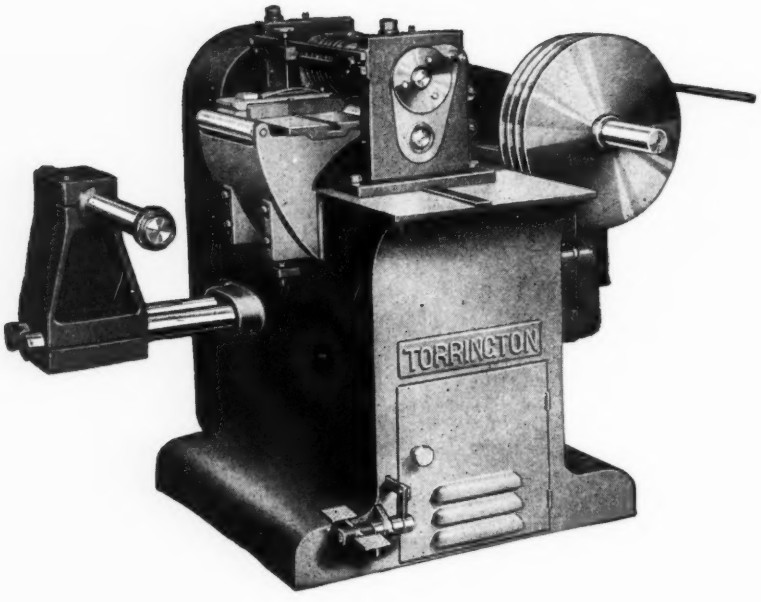
NUMBERING MACHINES
Noble & Westbrook Mfg. Co.

NUT MAKING MACHINERY
National Machinery Co.

NUT SETTING EQUIPMENT
See Screw Driving and Nut Setting Equipment.

LOW COST
METAL SLITTING MACHINES

For Warehouse and other Short Run Requirements



The simplified design of the new Torrington Warehouse Metal Slitting Machines permits quick adjustment for any desired combination of cuts on any gauge metal within their ranges. Maximum capacity of the Model 1773 (illustrated) is 5 cuts (4 strips) .080" non-ferrous or .062" mild steel, or an equivalent number of additional cuts in thinner gauges up to 12" or 18" maximum trimmed width.

A larger size, the 1778, has a capacity of 5 cuts of .110" non-ferrous metal, or .093" mild steel, or equivalent. Built for 12", 18" or 24" maximum widths.

On both models, manual adjustment of the upper arbor is simple, and provides generous compensation for cutter wear.

Housings, payoff, winder and motor drive are mounted on a single welded steel base which reduces floor space to a minimum. Moving parts are well guarded for safety. The elimination of gearing by means of continuous roller chain drive assures smooth operation.

With this newest Torrington Slitter, you get engineering "know-how" that can only result from 60 years experience in designing and building auxiliary mill equipment.

The **TORRINGTON**
MANUFACTURING COMPANY
TORRINGTON, CONNECTICUT

NUT TAPPERS
See Bolt and Nut Machinery.

NUTS, Cold Forged, Wing and Cap
Parker-Kalon Corp.
Republic Steel Corp.
(Union Drawn Steel Div.)

NUTS, Self-Locking
Elastic Stop Nut Corp. of America

NUTS, Thumb or Wing and Cap
Republic Steel Corp.
(Union Drawn Steel Div.)
Williams, J. H., & Co.

OIL CAPS
Besly, Chas. H., & Co.
Gits Bros. Mfg. Co.
Trico Fuse Mfg. Co.

OIL EXTRACTORS
DeLaval Separator Co.

OIL GROOVERS
Hanson-Whitney Mch. Co.
Wicaco Machine Corp.

OIL HOLE COVERS
Gits Bros. Mfg. Co.

OILERS AND LUBRICATORS
Gits Bros. Mfg. Co.
Madison-Kipp Corp.
Manzel Brothers Co.
Trico Fuse Mfg. Co.

OILS, Cutting
Cimcool Div., Cincinnati Milling Machine Co.
Cities Service Oil Co.
Gulf Oil Corp.
Stuart, D. A., Oil Co., Ltd.
Sun Oil Co.
Texas Co.
Tide Water Associated Oil Co.

Lubricating
Besly, Chas. H., & Co.
Cities Service Oil Co.
Gulf Oil Corp.
Sinclair Refining Co.
Standard Oil Co. (Indiana)
Stuart, D. A., Oil Co., Ltd.
Sun Oil Co.
Texas Co.
Tide Water Associated Oil Co.

Quenching and Tempering
Cities Service Oil Co.
Gulf Oil Corp.
Standard Oil Co. (Indiana)
Stuart, D. A., Oil Co., Ltd.

Soluble
See Compounds, Cutting, Grinding, Metal Drawings, Etc.

ORDNANCE MACHINES, Special
Rehnberg-Jacobson Mfg. Co.

PACKING, Leather, Metal, Rubber, Asbestos, Etc.
Garlock Packing Co.
Raybestos-Manhattan, Inc., Manhattan Rubber Div.

PARALLELS
Brown & Sharpe Mfg. Co.
Johansson Div., Ford Motor Co.
Starrett, L. S., Co.
Taft-Peirce Mfg. Co.
Walker, O. S., Co., Inc.

PATTERNS, WOOD
Mummert-Dixon Co.

PHOSPHOR BRONZE—See Bronze.

PILLOW BLOCKS
Norma-Hoffmann Bearings Corp.
S K F Industries, Inc.
Standard Pressed Steel Co.

PIPE, BRASS AND COPPER
American Brass Co.

PIPE CUTTING AND THREADING MACHINES
Foote-Burt Co.
Landis Mch. Co., Inc.
Oster Manufacturing Co.

PIPE JOINTS, SWIVEL
Chiksan Co.

PIPE, STEEL
Allegheny Ludlum Steel Corp.
Bethlehem Steel Co.
Jones & Laughlin Steel Corp.
National Tube Co.
(U. S. Steel Corp. Div.)
Republic Steel Corp.
(Union Drawn Steel Div.)
Ryerson, Joseph T., & Son, Inc.

PIPE TONGS
Williams, J. H., & Co.

PLANER ATTACHMENTS
Cincinnati Planer Co.
Consolidated Mch. Tool Co.
Hanson-Whitney Mch. Co.
Rockford Machine Tool Co.

PLANERS
Baldwin Locomotive Works
Cincinnati Planer Co.
Consolidated Mch. Tool Corp.
(Incl. Plate, Rotary and Crank Types)
Rockford Machine Tool Co.

Openside
Cincinnati Planer Co.
Rockford Machine Tool Co.

PLATE ROLLS
Baldwin Locomotive Works
Bethlehem Steel Co.
Cleveland Punch & Shear Wks. Co.
Consolidated Mch. Tool Corp.
Hannifin Corp.
Ryerson, Joseph T., & Son, Inc.

PLATES, Surface
Brown & Sharpe Mfg. Co.

Jones Machine Tool Wks., Inc.
Rotor Tool Co.
Scherr, George, Co., Inc.
Taft-Peirce Mfg. Co.
U. S. Tool Company, Inc.

PNEUMATIC EQUIPMENT

Bliss, E. W., Co.
Hanna Engineering Works
Hannifin Corp.
Ingersoll-Rand Co.
Logansport Machine Co., Inc.

POLISHING LATHES and Machines

Bellows Co.
Besly, Chas. H., & Co.
Bridgeport Safety Emery Wheel Co., Inc.
Gardner Machine Co.
Production Mch. Co.
Sundstrand Mch. Tool Co.

POLISHING TOOLS, Portable

Stow Mfg. Co.
Strand, N. A., & Co.

PRESSES

Arbor

Baldwin Locomotive Works
Canedy-Otto Mfg. Co.
Elmes Engineering Works
Famco Machine Co.
Farquhar, A. B., Co.
Hannifin Corp.
Logansport Machine Co., Inc.
Sheldon Mch. Co.

Broaching

American Broach & Mch. Co.
Bliss, E. W., Co.
Lapointe Machine Tool Co.
Oilgear Co.
Peck, Stow & Wilcox Co.
V & O Press Co.

Extrusion

Chambersburg Engineering Co.
Hydropress Co., Inc.
Lake Erie Engineering Corp.

Foot

Baird Machine Co.
Bliss, E. W., Co.
Famco Machine Co.
Niagara Machine & Tool Wks.
Peck, Stow & Wilcox Co.
Taylor & Fenn Co.
V. & O. Press Co.

Forging

Ajax Manufacturing Co.
Baldwin Locomotive Works
Bethlehem Steel Co.
Bliss, E. W., Co.
Clearing Mch. Co.
Cleveland Punch & Shear Works Co.
Erie Foundry Co.
Farquhar, A. B., Co.
Henry & Wright Mfg. Co.
Hydropress Co., Inc.
Lake Erie Engineering Corp.
Morgan Engineering Co.
National Machinery Co.
Niagara Machine & Tool Wks.
Peck, Stow & Wilcox Co.
Verson Allsteel Press Co.
V & O Press Co.
Zeh & Hahnemann Co.

Hydraulic

Air-Hydraulics, Inc.
American Broach & Mch. Co.
Baldwin Locomotive Works
Bethlehem Steel Co.
Birdsboro Steel Fdry. & Mch. Co.
Bliss, E. W., Co.
Chambersburg Engineering Co.
Clearing Mch. Co.
Colonial Broach Co.
Denison Engineering Co.
Elmes Engineering Co.
Erie Foundry Co.
Farrel-Birmingham Co., Inc.
Farquhar, A. B., Co.
Hannifin Corp.
Hydropress Co., Inc.
Lake Erie Engineering Co.
Lapointe Machine Tool Co.
Morgan Engineering Co.
Oilgear Co.
Verson Allsteel Press Co.

Percussion

Wilson, K. R.

Screw

Bliss, E. W., Co.
Niagara Machine & Tool Wks.
Zeh & Hahnemann Co.

Sheet Metal Working

Baldwin Locomotive Works
Bliss, E. W., Co.
Cincinnati Shaper Co.
Clearing Mch. Co.
Cleveland Punch & Shear Works Co.
Consolidated Mch. & Tool Corp.
Famco Machine Co.
Farquhar, A. B., Co.
Henry & Wright Mfg. Co.
L & J Press Corp.
Lake Erie Engineering Corp.
Niagara Machine & Tool Wks.
Peck, Stow & Wilcox Co.
Quickwork-Whiting Div. of Whiting Corp.
Steelweld Mchry. Div. of Cleveland Crane & Engrg. Co.
Verson Allsteel Press Co.
V & O Press Co.
Zeh & Hahnemann Co.

Straightening

Baldwin Locomotive Works
Canedy-Otto Mfg. Co.
Chambersburg Engineering Co.
Colonial Broach Co.
Consolidated Mch. Tool Corp.
Elmes Engineering Works
Farquhar, A. B., Co.
Hannifin Corp.
Jones Machine Tool Wks., Inc.
Morgan Engineering Co.
Oilgear Co.
Springfield Mch. Tool Co.

PRINT PAPER, BLUE, WHITE, ETC.

Ozalid Products Div. General Aniline & Film Corp.

PROFILING ATTACHMENT FOR LATHES

Accreylon Co.

PROFILING MACHINES

Cochrane-Bly Co.
Consolidated Mch. Tool Corp.
DoAll Co.
Gorton, George, Mch. Co.
Leland-Gifford Co.
Morey Mchry. Co., Inc.
Pratt & Whitney Co.
Reed-Prentice Corp.

PULLEYS

Boston Gear Works, Inc.
Hill Acme Co.

Friction Clutch

Brown & Sharpe Mfg. Co.

PUMPS, Coolant, Lubricant and Oil

Brown & Sharpe Mfg. Co.
DeLaval Steam Turbine Co.
Ingersoll-Rand Co.
Logansport Machine Co., Inc.
Pioneer Pump & Mfg. Co.
Ruthman Machinery Co.
Tuthill Pump Co.
Viking Pump Co.

Hydraulic

Baldwin Locomotive Works
Barnes, John S., Corp.
Bethlehem Steel Co.
Brown & Sharpe Mfg. Co.
Chambersburg Engineering Co.
DeLaval Steam Turbine Co.
Elmes Engineering Works
Hydropress Co., Inc.
Ingersoll-Rand Co.
Lapointe Machine Tool Co.
Oilgear Co.
Sundstrand Mch. Tool Co.
Tuthill Pump Co.
Viking Pump Co.

Pneumatic

Ingersoll-Rand Co.

Rotary

Brown & Sharpe Mfg. Co.
DeLaval Steam Turbine Co.
Pioneer Pump & Mfg. Co.
Tuthill Pump Co.
Viking Pump Co.

PUNCHES AND DIES

See Dies, Sheet Metal, Etc.

PUNCHES, CENTERING

Cleveland Punch & Shear Works Co.

PUNCHING MACHINERY

Buffalo Forge Co.
Cincinnati Shaper Co.
Cleveland Punch & Shear Wks Co.
Consolidated Mch. Tool Corp.
Hannifin Corp.
Niagara Machine & Tool Wks.
Peck, Stow & Wilcox Co.
Ryerson, Joseph T., & Son, Inc.
Steelweld Mchry. Div. of Cleveland Crane & Engrg. Co.
Wiedemann Machine Co.

PUNCHING AND RIVETING MACHINES

Hannifin Corp.

PYROMETERS

Bristol Co.
Leeds & Northrup Co.
Shore Instrument & Mfg. Co.

RACKS, GEAR, CUT

Boston Gear Works, Inc.
Brown & Sharpe Mfg. Co.
Fellows Gear Shaper Co.
Hartford Special Mchry. Co.
Massachusetts Gear & Tool Co.
Meisel Press Mfg. Co.
Philadelphia Gear Works
Stahl Gear & Machine Co.

REAMER HOLDERS

Gairing Tool Co.
Gisholt Machine Co.
Landis Mch. Co., Inc.
Lipe-Rollway Corporation
Warner & Swasey Co.

REAMERS

Barber-Colman Co.
Butterfield Div., Union Twist Drill Co.
Carboloy Co., Inc.
Cleveland Twist Drill Co.
Columbus Die, Tool & Mch. Co.
Ex-Cell-O Corporation
Firth-Sterling Steel & Carbide Corp.
Gairing Tool Co.
Gammons-Hoaglund Co.
Gisholt Machine Co.
Greenfield Tap & Die Corp.
Haynes Stellite Co.
Keo Cutter Co.
Lipe-Rollway Corporation
Morse Twist Drill & Mch. Co.
National Twist Drill & Tool Co.
Pratt & Whitney Co.
Standard Tool Co.
Super Tool Co.
Union Twist Drill Co.

Adjustable

Barber-Colman Co.
Carboloy Co., Inc.
Cleveland Twist Drill Co.
Ex-Cell-O Corporation
Firth-Sterling Steel & Carbide Corp.
Gairing Tool Co.
Gisholt Machine Co.
Greenfield Tap & Die Corp.
Morse Twist Drill & Mch. Co.
Pratt & Whitney Co.
Rogers, John M., Tool Corp.
Standard Tool Co.
Taft-Peirce Mfg. Co.
Union Twist Drill Co.

Taper Pin

Butterfield Div., Union Twist Drill Co.
Gammons-Hoaglund Co.
Greenfield Tap & Die Corp.
Lipe-Rollway Corporation
Morse Twist Drill & Mch. Co.
National Twist Drill & Tool Co.
Pratt & Whitney Co.
Standard Tool Co.
Union Twist Drill Co.

REAMING MACHINES

Van Norman Co.

RECORDING INSTRUMENTS

For Counting

National Acme Co.

For Electricity

Bristol Co.
Leeds & Northrup Co.

For Pressure

Bristol Co.
Leeds & Northrup Co.

For Speed

Bristol Co.
Leeds & Northrup Co.

For Temperature

Bristol Co.
Leeds & Northrup Co.

REELS, Stock, Standard and Automatic

S & S Mch. Wks.
U. S. Tool Company, Inc.

REFRACTORIES, Heat Treating Furnace

Norton Co.

REGULATORS, Temperature

Bristol Co.
Leeds & Northrup Co.

REMOVERS, Japan, Enamel, Etc.

Oakite Products, Inc.

RETAINING RINGS FOR BEARINGS, ETC.

Waldes Kohinoor, Inc.

RHEOSTATS

Allen-Bradley Co.

RIVET SETS

Bethlehem Steel Co.
Cleco Pneumatic Tool Div.
Cleveland Punch & Shear Works Co.

RIVETERS, Hydraulic

Bethlehem Steel Co.
Hanna Engineering Works
Hannifin Corp.
Morgan Engineering Co.

Pneumatic

Cleco Pneumatic Tool Div.
Grant Mfg. & Mch. Co.
Hanna Engineering Works
Hannifin Corp.
Ingersoll-Rand Co.
Ryerson, Joseph T., & Son, Inc.

RIVETING MACHINES

Buffalo Forge Co.
Grant Mfg. & Mch. Co.
Hanna Engineering Works
Hannifin Corp.
Peck, Stow & Wilcox Co.
Producto Machine Co.

RIVET MAKING MACHINES

Hill Acme Co.
National Machinery Co.

RUBBER PRODUCTS

Raybestos-Manhattan, Inc., Manhattan Rubber Div.

RULES, Steel

Brown & Sharpe Mfg. Co.
Scherr, George, Co., Inc.
Starret, L. S., Co.

RUST PREVENTATIVE

Oakite Products, Inc.
Scherr, George, Co., Inc.

SAND BLAST EQUIPMENT

See Blast Cleanig Equipment.

SANDERS

Carborundum Co.
Delta Mfg. Div. Rockwell Mfg. Co.
Ingersoll-Rand Co.
Porter-Cable Machine Co.
Rotor Tool Co.
Sundstrand Mch. Tool Co.
Walls Sales Corp.

SAW BLADES, HACK

Armstrong-Blum Mfg. Co.
Simond Saw & Steel Co.
Starret, L. S., Co.

SAW SHARPENING MACHINES

Cochrane-Bly Co.
Earle Gear & Mch. Co.
Huther Bros. Saw Mfg. Co., Inc.
Scherr, George, Co., Inc.

SAWING MACHINES

Circular

Cochrane-Bly Co.
Consolidated Machine Tool Corp.
Earle Gear & Mch. Co.
Motch & Merryweather Mchry. Co.

Friction

Ryerson, Joseph T., & Son, Inc.

Metal Cutting Band

Armstrong-Blum Mfg. Co.
Avey Drilling Machine Co.
Delta Mfg. Div. Rockwell Mfg. Co.
DoAll Co.
Grob Brothers
Huther Bros. Saw Mfg. Co., Inc.
Ryerson, Joseph T., & Son, Inc.
Simonds Saw & Steel Co.

Power Hack

Armstrong-Blum Mfg. Co.
Ryerson, Joseph T., & Son, Inc.

SAWS, Circular Metal Cutting

Brown & Sharpe Mfg. Co.
Cochrane-Bly Co.
Consolidated Mch. Tool Corp.
Huther Bros. Saw Drill & Tool Co.
National Twist Drill Co.
Simonds Saw & Steel Co.
Standard Tool Co.
Union Twist Drill Co.
Walker-Turner Co., Inc.

Metal Cutting Band

Armstrong-Blum Mfg. Co.
Delta Mfg. Div. Rockwell Mfg. Co.
DoAll Co.
Huther Bros. Saw Mfg. Co., Inc.
Ryerson, Joseph T., & Son, Inc.
Starrett, L. S., Co.
Walker-Turner Co., Inc.
Wells Manufacturing Corp.

Screw Slotting

Barber-Colman Co.
Brown & Sharpe Mfg. Co.
Greenfield Tap & Die Corp.
Morse Twist Drill & Mch. Co.
National Twist Drill & Tool Co.
Simonds Saw & Steel Co.
Starrett, L. S., Co.
Union Twist Drill Co.

SCRAPERS, Hand and Power

Anderson Bros. Mfg. Co.

SCREW DRIVING AND NUT SETTING EQUIPMENT

Errington Mechanical Laboratory
Haskins, R. G., Co.
Ingersoll-Rand Co.
Procunier Safety Chuck Co.
Strand, N. A., & Co.

SCREW MACHINES, Automatic, Single and Multiple Spindle

Brown & Sharpe Mfg. Co.
Cleveland Automatic Machine Co.
Cone Automatic Machine Co., Inc.
Foote-Burt Co.
Greenlee Bros. & Co.
National Acme Co.
New Britain-Gridley Mch. Div., New Britain Machine Co.
Scherr, George, Co., Inc.

SCREW MACHINES, Hand

See also Lathes, Turret.
Bardons & Oliver, Inc.
Brown & Sharpe Mfg. Co.
Gisholt Mch. Co.
Hardinge Brothers, Inc.
Jones & Lamson Machine Co.
Rivett Lathe & Grinder, Inc.
Simmons Machine Tool Corp.
Stark Tool Co.
Warner & Swasey Cor.

SCREW MACHINE TOOLS AND EQUIPMENT

Bardons & Oliver, Inc.
Brown & Sharpe Mfg. Co.
Cleveland Automatic Machine Co.
Gisholt Mch. Co.
Greenlee Bros. & Co.
Jones & Lamson Machine Co.
Landis Mch. Co., Inc.
National Acme Co.
New Britain-Gridley Mch. Div., New Britain Machine Co.
Potter & Johnston Machine Co.
R and L Tools
Warner & Swasey Co.

SCREW MACHINE WORK

Aluminum Co. of America
Eastern Mch. Screw Corp.
Morse Twist Drill & Mch. Co.
National Acme Co.
Standard Pressed Steel Co.
Wicaco Machine Corp.

SCREW PLATES

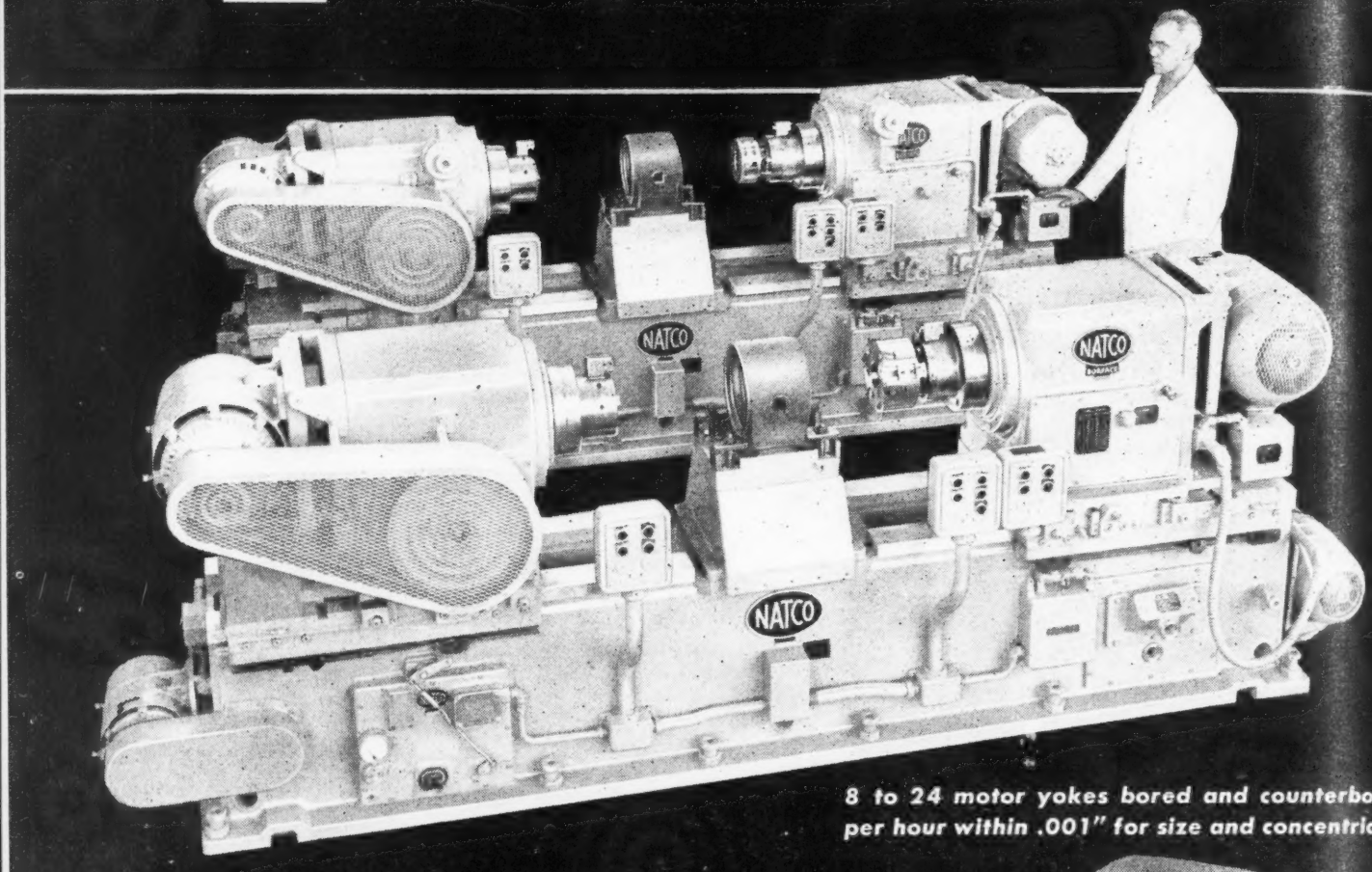
Besly, Chas. H., & Co.
Butterfield Div., Union Twist Drill Co.
Carl, S. W., Mfg. Co
Greenfield Tap & Die Corp.
Morse Twist Drill & Mch. Co.
Pratt & Whitney Co.

SCREWS

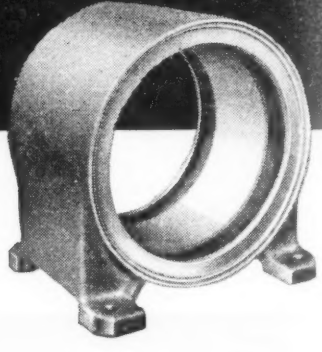
Cap, Set, Safety Set and Machine

Allen Mfg. Co.
American Screw Co.
Bristol Co.
Central Screw Co.
Chandler Products Corp.
Continental Screw Co.
Corbin Screw Div. of American Hardware Corp.
Elco Tool Screw Corp.
General Screw Mfg. Co.
Harper, H. M., & Co.
Holo-Krome Screw Corp.

How new NATCO BORFACE Unit Machines.. .pre



8 to 24 motor yokes bored and counterbored per hour within .001" for size and concentricity.



Example for an electric motor manufacturer

The newly developed NATCO A20A BORFACE Units make possible multi-way type precision boring and permit for the first time the rapid production of accurate bores in large hard-to-handle castings by semi-skilled operators.

The two BORFACE machines above were built for an electric motor manufacturer and are arranged for rough and finish boring a range of 8 sizes of cast iron N.E.M.A. frame motor yokes having a minimum central bore of 7" to 11½" diameter with counterbore varying from 9¼" to 14⅝" diameter. Depth of counterbore is 3/16".

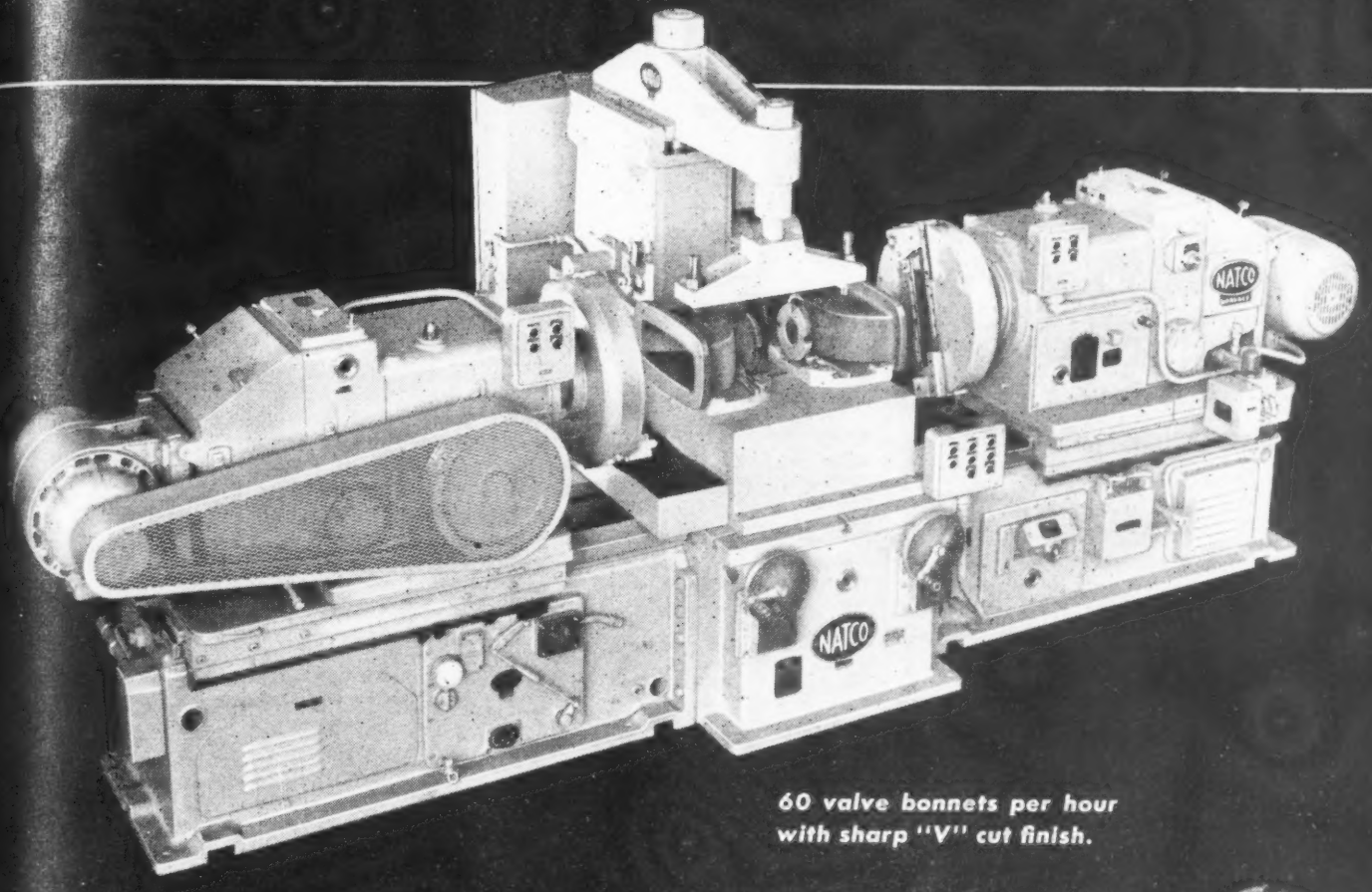
Machine in the foreground is constructed of 2 model A20A BORFACE Units for rough boring and counterboring using AC drive motors for the spindles, and machine in background is a duplicate except it is driven by DC motors to permit variable speed in a wide range for maximum cutting efficiency and fine finish in final bore and counterbore operations held to limits of ±.001".

JUST OFF THE PRESS

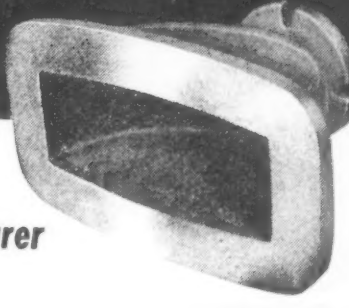
Write Today for your Colorful New ___ Booklet!

The complete story of these newly perfected BORFACE unit machines is now ready for immediate distribution in complete illustrated form. Write NATCO Department M; Richmond, Ind.

...precision turn, bore and face large, cumbersome parts faster, better



60 valve bonnets per hour with sharp "V" cut finish.



Example *for a valve and fitting manufacturer*

NATCO A20B BORFACE Units provide the same spindle construction as the A20A machine except for the cross facing drive and control unit. On the BORFACE machine shown here a two-way operation has been provided for a prominent manufacturer of valves and fittings which permits facing 2 bonnets simultaneously. This operation calls for a machine that can cut a flat surface with "phonograph" finish so as to bite into gaskets and hold under pressure.

The application of NATCO automatic clamping makes possible faster loading and unloading of awkward parts and eliminates the large cumbersome revolving cradle type fixtures usually found on other machines attempting this work.

Investigate this type of equipment where work is large and awkward to handle or swing on boring mills and lathes.

NATCO DRILLING, BORING AND TAPPING MACHINES

NATCO

"Here is another example of SUPERKOOL superiority for precision grinding"

...excerpts from D. A. Stuart Oil Co. Performance Report on SUPERKOOL 31K

PROBLEM: Precision grinding finish of 4 to 6 micro inches required on compressor valve units, using a 500 grit wheel on Norton Hyprolap machines. Previous mixture of 1 part kerosene and 2 parts red engine oil unsatisfactory.

SOLUTION: Use of a 1 to 1 blend of SUPERKOOL 31K and kerosene.

RESULTS: Operator reported less mist from the machine...Production increased to 200 pieces...Finish improved 2 to 4 micro inches...subsequent tests proved completely satisfactory results by using SUPERKOOL 31K straight on micromatics, and the above dilution on the Hyprolap machines... Foreman and lubrication engineer well pleased...orders for SUPERKOOL 31K to be placed as required.

O. M. Gibson

D. A Stuart Oil Co., Representative

STUART *service goes with every barrel*

WRITE FOR DETAILS

D.A. Stuart Oil CO.

2739 SOUTH TROY STREET, CHICAGO 23, ILL.

International Screw Co.
Lamson & Sessions Co.
Milford Rivet & Machine Co.
National Acme Co.
National Lock Co.
National Screw & Mfg. Co.
New England Screw Co.
Parker-Kalon Corp.
Pawtucket Screw Co.
Pheoll Mfg. Co.
Reading Screw Co.
Republic Steel Corp.
(Union Drawn Steel Div.)
Russell Burdsall & Ward Bolt & Nut Co.
Scovill Mfg. Co.
Shakeproof, Inc.
Southington Hardware Co.
Standard Pressed Steel Co.
Steel Co. of Canada, Ltd.
Sterling Bolt Co.
Stronghold Screw Products
Whitney Screw Corp.
Wolverine Belt Co.

SCREWS, Self-Tapping Drive

Parker-Kalon Corp.

SCREWS, Thumb

American Screw Co.
Parker-Kalon Corp.
Williams, J. H., & Co.

SEALS AND RETAINERS

Oil or Grease

Garlock Packing Co.
Gits Bros. Mfg. Co.

SEAMLESS STEEL TUBING

See Tubing, Seamless Steel.

SECOND HAND MACHINERY, Etc.

Botwinik Brothers of Mass., Inc.
Cincinnati Machinery Co., Inc.
Eastern Machinery Co.
Miles Machinery Co.
Simmons Machine Tool Corp.

SEPARATORS

Centrifugal

DeLaval Separator Co.

Magnetic

Frantz, S. G., Co., Inc.

Oil or Coolant

Barnes Drill Co.
Frantz, S. G., Co., Inc.
National Acme Co.

SHAFTING, STEEL

Bethlehem Steel Co.
Cumberland Steel Co.
Jones & Laughlin Steel Corp.
National Tube Co.
(U. S. Steel Corp., Div.)
Ryerson, Joseph T., & Son, Inc.

SHAFTS

Standard Pressed Steel Co.

Flexible

Haskins, R. G., Co.
Strand, N. A., & Co.

Hollow Bored

American Hollow Boring Co.
Bethlehem Steel Co.

Turned and Ground

Bethlehem Steel Co.
Cumberland Steel Co.
Jones & Laughlin Steel Corp.
Ryerson, Joseph T., & Son, Inc.

SHAPERS

American Tool Works Co.
Atlas Press Co.
Cincinnati Shaper Co.
General Engrg. & Mfg. Co.
Hendey Machine Co.
Rockford Mch. Tool Co.

Vertical

Hanson-Whitney Mfg. Co.
Jones Machine Tool Wks., Inc.
Pratt & Whitney Co.
Rockford Mch. Tool Co.

SHAPES, Structural

Aluminum Co. of America
Bethlehem Steel Co.
Jones & Laughlin Steel Corp.

SHEARING MACHINERY

Bethlehem Steel Co.
Buffalo Forge Co.
Cincinnati Shaper Co.
Cleveland Punch & Shear Works Co.
Consolidated Mch. Tool Corp.
Hannifin Corp.
Hydropress Co., Inc.
Morgan Engineering Co.
Niagara Mch. & Tool Wks.
O'Neil-Irwin Mfg. Co.
Peck, Stow & Wilcox Co.
Quickwork-Whiting Div. of Whiting Corp
Ryerson, Joseph T., & Son, Inc.
Yoder Co.

SHEARS, Alligator

Hill Acme Co.

SHEARS

Rotary

Bliss, E. W., Co.
Brown & Sharpe Mfg. Co.
Cleveland Punch & Shear Works Co.
Consolidated Mch. Tool Corp.
Niagara Mch. & Tool Wks.
Peck, Stow & Wilcox Co.
Quickwork-Whiting Div. of Whiting Corp.
Ryerson, Joseph T., & Son, Inc.
Union Twist Drill Co.

Squaring

Cincinnati Shaper Co.
Cleveland Punch & Shear Works Co.
Consolidated Mch. Tool Corp.
Niagara Mch. & Tool Wks.
Peck, Stow & Wilcox Co.

SHEET METALS

Aluminum Co. of America
American Brass Co.
Bethlehem Steel Co.
Ryerson, Joseph T., & Son, Inc.

SHEETS, Iron and Steel

Allegheny Ludlum Steel Corp.
Bethlehem Steel Co.
Jones & Laughlin Steel Corp.
Republic Steel Corp.
(Union Drawn Steel Div.)
Ryerson, Joseph T., & Son, Inc.

Perforated

Chicago Perforating Co.

SINE BARS

Johansson Div., Ford Motor Co.
Starrett, L. S., Co.

SLEEVES

Cleveland Twist Drill Co.
Greenfield Tap & Die Corp.
Morse Twist Drill & Mch. Co.
National Twist Drill & Tool Co.
Pratt & Whitney Co.
Standard Tool Co.
Union Twist Drill Co.

SLOTTING MACHINES

Baker Brothers, Inc.
Consolidated Mch. Tool Corp.
Jones Machine Tool Wks., Inc.
Lobdell Co.
Rockford Mch. Tool Co.

SOCKETS

Cleveland Twist Drill Co.
Greenfield Tap & Die Corp.
Morse Twist Drill & Mch. Co.
National Twist Drill & Tool Co.
Pratt & Whitney Co.
Standard Tool Co.
Union Twist Drill Co.
Williams, J. H., & Co.

SPECIAL MACHINERY AND TOOLS

American Type Foundries, Inc.
Baird Machine Co.
Baldwin Locomotive Works
Barnes Drill Co.
Barnes, W. F. & John, Co.
Baush Machine Tool Co.
Bethlehem Steel Co.
Bilgram Gear & Mch. Wks.
Birdsboro Steel Fdry. & Mch. Co.
Blanchard Machine Co.
Bliss, E. W., Co.
Chambersburg Engineering Co.
Columbus Die, Tool & Machine Co.
Consolidated Mch. Tool Corp.
Cross Co.
Denison Engineering Co.
Earle Gear & Mch. Co.
Elgin Tool Wks., Inc.
Ex-Cell-O Corp.
Farrel-Birmingham Co., Inc.
Gairing Tool Co.
Gisholt Mch. Co.
Gorton, George, Mch. Co.
Grant Mfg. & Mch. Co.
Greenlee Bros & Co.
Hannifin Corp.
Hartford Special Mchry. Co.
Hill Acme Co.
Ingersoll Milling Mch. Co.
Jones Machine Tool Wks., Inc.
Lake Erie Engineering Corp.
Langelier Mfg. Co.
LeMaire Tool & Mfg. Co.
Lipe-Rollway Corporation
Moline Tool Co.
Morgan Engineering Co.
Morse Twist Drill & Mch. Co.
National Acme Co.
National Automatic Tool Co.
National Tool Co.
National Twist Drill & Tool Co.
New Britain-Gridley Mch. Div.,
New Britain Mch. Co.
New Jersey Gear & Mfg. Co.
Niagara Mch. & Tool Wks.
Oilgear Co.
Peck, Stow & Wilcox Co.
Pioneer Pump & Mfg. Co.
Pratt & Whitney Co.
Reed-Prentice Co.
Rogers, John M., Tool Corp.
Ruthman Machinery Co.
S. & S. Mch. Works
Snyder Tool & Engrg. Co.
Sundstrand Mch. Tool Co.
Taft-Peirce Mfg. Co.
Union Twist Drill Co.
U. S. Tool Company, Inc.
V & O Press Co.
Waltham Mfg. Wks.
Wicaco Machine Corp.

SPEED REDUCERS

Boston Gear Works, Inc.
Brad Foote Gear Works
Cleveland Worm & Gear Co.
Davis & Thompson Co.
DeLaval Steam Turbine Co.
Farrel-Birmingham Co., Inc.
Ganschow Gear Co.
Grant Gear Works, Inc.
Michigan Tool Co.
Philadelphia Gear Works
Shepard Niles Crane & Hoist Corp.

SPINDLES, Grinding

Ex-Cell-O Corporation
Pope Machinery Corp.

SPINDLES, Hollow Bored

American Hollow Boring Co.

SPINNING LATHES

See Chucking Machines.

SPRING COILING AND FORMING MACHINERY

Baird Machine Co.
Torrington Mfg. Co.

SPRINGS, WIRE

Hunter Pressed Steel Co.

SPROCKET CHAINS

Boston Gear Works, Inc.
Grant Gear Works, Inc.
Philadelphia Gear Works

SPROCKETS

Boston Gear Works, Inc.
Eberhardt-Denver Co.
Grant Gear Works, Inc.
Hartford Special Mchry. Co.
Philadelphia Gear Works

STAMPINGS, Sheet Metal

Aluminum Co. of America
Quadriga Mfg. Co.

STAMPS, Steel, and Marking Dies

Noble & Westbrook Mfg. Co.
Pittsburgh Stamp Co., Inc.
Sossner, Inc.

STEEL

Allegheny Ludlum Steel Corp.
Bethlehem Steel Co.
Carpenter Steel Co.
Crucible Steel Co. of America
Firth-Sterling Steel & Carbide Corp.
Jones & Laughlin Steel Corp.
Republic Steel Corp.
(Union Drawn Steel Div.)
Ryerson, Joseph T., & Son, Inc.
Simonds Saw & Steel Co.
Timken Roller Bearing Co.
Vanadium Alloys Steel Co.
Wheelock, Lovejoy & Co., Inc.

Cold Drawn

Allegheny Ludlum Steel Corp.
Bethlehem Steel Co.
Crucible Steel Co. of America
Firth-Sterling Steel & Carbide Corp.
Jones & Laughlin Steel Corp.
Ryerson, Joseph T., & Son, Inc.
Timken Roller Bearing Co.
Vanadium Alloys Steel Co.
Wheelock, Lovejoy & Co., Inc.

Composite Tool and Die

Firth-Sterling Steel & Carbide Corp.

High Speed Tool

Allegheny Ludlum Steel Corp.
Armstrong Bros. Tool Co.
Bethlehem Steel Co.
Carpenter Steel Co.
Cleveland Twist Drill Co.
Crucible Steel Co. of America
Firth-Sterling Steel & Carbide Corp.
Republic Steel Corp.
(Union Drawn Steel Div.)
Ryerson, Joseph T., & Son, Inc.
Simonds Saw & Steel Co.
Vanadium Alloys Steel Co.
Wheelock, Lovejoy & Co., Inc.

Machine

Bethlehem Steel Co.
Crucible Steel Co. of America
Jones & Laughlin Steel Corp.
Republic Steel Corp.
(Union Drawn Steel Div.)
Ryerson, Joseph T., & Son, Inc.
Timken Roller Bearing Co.
Vanadium Alloys Steel Co.
Wheelock, Lovejoy & Co., Inc.

Rustless

Allegheny Ludlum Steel Corp.
Bethlehem Steel Co.
Carpenter Steel Co.
Crucible Steel Co. of America
Firth-Sterling Steel & Carbide Corp.
Ingersoll Steel & Disc Div.,
Borg Warner Corp.
Republic Steel Corp.
(Union Drawn Steel Div.)

Stainless

Allegheny Ludlum Steel Corp.
Bethlehem Steel Co.
Carpenter Steel Co.
Crucible Steel Co. of America
Republic Steel Corp.
(Union Drawn Steel Div.)
Ryerson, Joseph T., & Son, Inc.
Timken Roller Bearing Co.
Wheelock, Lovejoy & Co., Inc.

Strip and Sheet

Allegheny Ludlum Steel Corp.
Bethlehem Steel Co.
Jones & Laughlin Steel Corp.
Republic Steel Corp.
(Union Drawn Steel Div.)
Ryerson, Joseph T., & Son, Inc.

Zinc, Tin and Copper Coated Strip

Allegheny Ludlum Steel Corp.

STEEL ALLOYS

See Alloy Steels.

STEEL BARS—See Bars, Steel.

STEEL STOCK GROUND FLAT

Brown & Sharpe Mfg. Co.
Starrett, L. S., Co.

STELLITE

Haynes Stellite Co.

STOCKS, Die

Butterfield Div., Union Twist Drill Co.
Card, S. W., Mfg. Co.
Greenfield Tap & Die Corp.
Morse Twist Drill & Mch. Co.
Oster Manufacturing Co.
Pratt & Whitney Co.
Standard Tool Co.

STONES, Oil or Sharpening
Bay State Abrasive Co.
Carborundum Co.

STOOLS
Standard Pressed Steel Co.

STRAIGHT EDGES
Brown & Sharpe Mfg. Co.
Johansson Div., Ford Motor Co.
Jones Machine Tool Wks., Inc.
Starrett, L. S., Co.

STRAIGHTENING MACHINERY
Baldwin Locomotive Works
Chambersburg Engineering Co.
Consolidated Mch. Tool Corp.
Hannifin Corp.
Lake Erie Engineering Corp.
Morse Twist Drill & Mch. Co.
Oilgear Co.
Springfield Mch. Tool Co.

STUD SETTERS
Errington Mechanical Laboratory
Procunier Safety Chuck Co.

SUB PRESSES
Baumbach, E. A., Mfg. Co.
U. S. Tool Co.
Waltham Mch. Wks.

SUPERFINISHING MACHINES
Norton Co.

SURFACE PLATES
See Plates, Surface.

SWAGING MACHINES
Cincinnati Shaper Co.
Langelier Mfg. Co.
Torrington Co.

SWITCHES
Allen-Bradley Co.
Lincoln Electric Co.
National Acme Co.
Shepard Niles Crane & Hoist Corp.
Westinghouse Electric Corp.

TACHOMETERS
Bristol Co.
Leeds & Northrup Co.
Scherr, George, Co., Inc.
Veeder-Root, Inc.

TAPE
Topflight Tool Co.

TAPER PINS, STANDARD
Morse Twist Drill & Mch. Co.
Pratt & Whitney Co.

TAP EXTENSIONS
Allen Mfg. Co.

TAP HOLDERS
Errington Mechanical Laboratory
Gairing Tool Co.
National Automatic Tool Co.
Procunier Safety Chuck Co.

TAPPING ATTACHMENTS AND DEVICES
Avey Drilling Machine Co.
Baker Brothers, Inc.
Brown & Sharpe Mfg. Co.
Buhr Machine Tool Co.
Detroit Tap & Tool Co.
Errington Mechanical Laboratory
Ettco Tool Co.
Leland-Gifford Co.
Modern Tool Wks.
National Automatic Tool Co.
Procunier Safety Chuck Co.

TAPPING MACHINES
Armstrong-Blum Mfg. Co.
Avey Drilling Machine Co.
Baker Brothers, Inc.
Barnes Drill Co.
Barnes, W. F. & John, Co.
Baush Machine Tool Co.
Bodine Corp.
Bradford Machine Tool Co.
Buffalo Forge Co.
Buhr Machine Tool Co.
Cleveland Tapping Machine Co.
Cross Co.
Detroit Tap & Tool Co.
Elgin Tool Wks., Inc.
Geometric Tool Co.
Greenlee Bros. & Co.
Haskins, R. G., Co.
Hill Acme Co.
Kingsbury Mch. Tool Corp.
Langelier Mfg. Co.
Leland-Gifford Co.
Moline Tool Co.
National Acme Co.
National Automatic Tool Co.
Procunier Safety Chuck Co.
Snow Mfg. Co.
Warner & Swasey Co.

TAPPING MACHINES, Nut
Hill Acme Co.
National Machinery Co.

TAPS
Bath, John, & Co., Inc.
Besly, Chas. H., & Co.
Butterfield Div., Union Twist Drill Co.
Card, S. W., Mfg. Co.
Continental Tool Works Div.
Detroit Tap & Tool Co.
Geometric Tool Co.
Greenfield Tap & Die Corp.
Hanson-Whitney Mch. Co.
Landis Mch. Co.
Morse Twist Drill & Mch. Co.
National Acme Co.
Pratt & Whitney Co.
Sossner, Inc.
Standard Tool Co.
Threadwell Tap & Die Co.
Wood & Spencer Co.
Woodworth, N. A., Co.

Collapsing
Geometric Tool Co.
Landis Mch. Co., Inc.
Modern Tool Wks.
National Acme Co.

THERMOMETERS, Indicating and Recording
Bristol Co.
Leeds & Northrup Co.

THREAD CUTTING MACHINERY
Brown & Sharpe Mfg. Co.
Eastern Machine Screw Corp.
Fellows Gear Shaper Co.
Geometric Tool Co.
Grant Mfg. & Mch. Co.
Hill Acme Co.
Landis Mch. Co., Inc.
Modern Tool Works
Oster Manufacturing Co.
Pratt & Whitney Co.
Rivett Lathe & Grinder, Inc.
Taft-Peirce Mfg. Co.

THREAD CUTTING TOOLS
Armstrong Bros. Tool Co.
Detroit Tap & Tool Co.
Eastern Machine Screw Corp.
Geometric Tool Co.
Hill Acme Co.
Landis Mch. Co., Inc.
Modern Tool Works
Oster Manufacturing Co.
Pratt & Whitney Co.
Rivett Lathe & Grinder, Inc.
Taft-Peirce Mfg. Co.
Williams, J. H., & Co.

THREAD GAGES
See Gages, Thread.

THREAD GRINDING MACHINES
See Grinding Machines, Thread.

THREAD MILLING MACHINES
Coulter, James, Machine Co.
Cross Co.
Hanson-Whitney Mch. Co.
Pratt & Whitney Co.
Waltham Mch. Wks.

THREAD ROLLING MACHINES
Hill Acme Co.
National Machinery Co.
Peck, Stow & Wilcox Co.
V & O Press Co.

TIN AND TERNE PLATES
Bethlehem Steel Co.
Jones & Laughlin Steel Corp.
Republic Steel Corp.
(Union Drawn Steel Div.)

TOOL BITS

High Speed Steel
Allegheny Ludlum Steel Corp.
Armstrong Bros. Tool Co.
Barber-Colman Co.
Carpenter Steel Co.
Crucible Steel Co. of America
Firth-Sterling Steel & Carbide Corp.
Ryerson, Joseph T., & Son, Inc.
Simonds Saw & Steel Co.
Vanadium Alloys Steel Co.
Wheelock, Lovejoy & Co., Inc.
Williams, J. H., & Co.

Special Alloy
Allegheny Ludlum Steel Corp.
Firth-Sterling Steel & Carbide Corp.
Haynes Stellite Co.

TOOL GRINDERS
See Grinders for Sharpening Turning and Planing Tools.

TOOL HEADS, Adjustable
Gairing Tool Co.

TOOL HOLDERS
Armstrong Brothers Tool Co.
Cleveland Twist Drill Co.
Gisholt Machine Co.
Jones & Lamson Mch. Co.
Lovejoy Tool Co., Inc.
Michigan Tool Co.
O.K. Tool Co., Inc.
R and L Tools
Warner & Swasey Co.
Williams, J. H., & Co.

TOOLMAKERS' INSTRUMENTS
Brown & Sharpe Mfg. Co.
Scherr, George, Co., Inc.
Starrett, L. S., Co.

TOOL STEEL
Allegheny Ludlum Steel Corp.
Bethlehem Steel Co.
Carpenter Steel Co.
Crucible Steel Co. of America
Firth-Sterling Steel & Carbide Corp.
Ryerson, Joseph T., & Son, Inc.

TOOLS

Carbide-Tipped
Allegheny Ludlum Steel Corp.
Carboloy Co., Inc.
Ex-Cell-O Corporation
Firth-Sterling Steel & Carbide Corp.
Gairing Tool Co.
Kennametal, Inc.
Metal Carbides Corp.
Michigan Tool Co.
Morse Twist Drill & Mch. Co.
Super Tool Co.
Vanadium Alloys Steel Co.

Lathe Shaper and Planer
Armstrong Brothers Tool Co.
Firth-Sterling Steel & Carbide Corp.
Gisholt Machine Co.
(For Lathes Only)
Haynes Stellite Co.
Jones & Lamson Mch. Co.
Kennametal, Inc.
O.K. Tool Co., Inc.
Super Tool Co.
Warner & Swasey Co.
Williams, J. H., & Co.

TRANSMISSION MACHINERY
See Hangers, Shafting, Pulleys, Clutches, Coupling, Belting, Chains, Etc.

TRANSMISSION, Variable Speed
DoAll Co.
Dynamatic Corp.
Oilgear Co.
Reeves Pulley Co.

TUBE FLANGING MACHINES
Grant Mfg. & Mch. Co.

TUBING, Aluminum
Aluminum Co. of America

TUBING

Brass and Copper
American Brass Co.

Flexible
Chicago Metal Hose Corp.
Titeflex, Inc.

Stainless Steel
Allegheny Ludlum Steel Corp.
Carpenter Steel Co.
Chicago Metal Hose Corp.
National Tube Co.
(U. S. Steel Corp., Div.)
Ryerson, Joseph T., & Son, Inc.
Timken Roller Bearing Co.

Steel and Stainless Steel
Allegheny Ludlum Steel Corp.
Bethlehem Steel Co.
Jones & Laughlin Steel Corp.
National Tube Co.
(U. S. Steel Corp., Div.)
Ryerson, Joseph T., & Son, Inc.
Timken Roller Bearing Co.

TUMBLING BARRELS
Baird Machine Co.

TUNGSTEN CARBIDE
Allegheny Ludlum Steel Corp.
Carboloy Co., Inc.
Firth-Sterling Steel & Carbide Corp.
Kennametal, Inc.
Metal Carbides Corp.
Super Tool Co.

TWIST DRILLS
See Drills, Twist

UNIONS
Dart, E. M., Mfg. Co.

UNIVERSAL JOINTS
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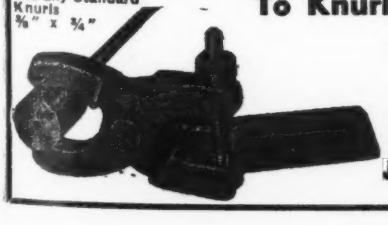

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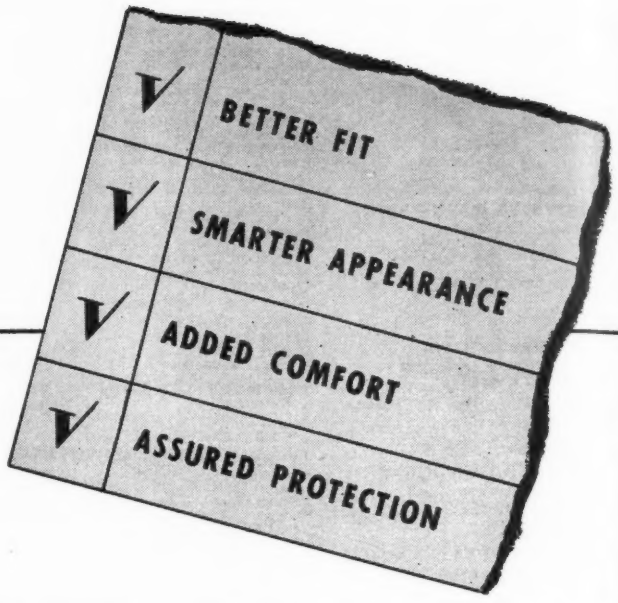

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For full description, send for Catalog 300. The Cleveland Worm & Gear Company, 3276 East 80th St., Cleveland 4, Ohio.

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CLEVELAND
Worm Gear
Speed Reducers

How Timken bearing development meets the specific needs of industry

He gives bearings a rub-down to put curves in the right places

THE operation shown here is typical of the many ways in which Timken tapered roller bearings are made to meet the specific needs of you who use them. As a final manufacturing process, certain types of Timken heavy duty thrust bearings are assembled and processed so that the surfaces of the ribs, rollers and races are generated as a unit. Through this special finishing operation, developed by Timken, the bearing becomes a "Generated Unit Assembly".

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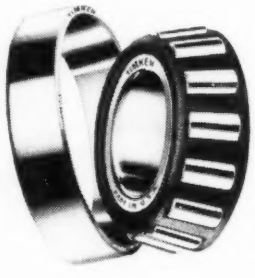
REMEMBER, Timken alone makes its own steel and is the acknowledged leader in: 1. advanced design; 2. precision manufacture; 3. rigid quality control; 4. special analysis steels. The Timken Roller Bearing Company, Canton 6, Ohio.

GENERATED UNIT ASSEMBLY

Extra manufacturing process makes Timken heavy duty thrust bearing a "Generated Unit Assembly".

CURVED AREA RIB CONTACT

Curved area of roll end (at arrows) fits perfectly the curve of upper and lower ribs of this thrust bearing.



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